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A Special Report

● After Hours:
MP3 Leads the
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On the Web

● Software to Go:
Palm and Win CE
Apps, Utilities,
Games, and More



▲ Trends: Sony's
2-Pound Laptop
With Built-In
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● Biometrics:
Space-Age Tech,
PC-Age Security

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- Macromedia Director 7
- ColdFusion 4.0
- Diamond HomeFree
- Maximizer Enterprise 5.0
- HP 2500Cxi
- Seagate's Client Exec 2.0
- Panda Antivirus



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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET

VOL.18 NO.4 FEBRUARY 23, 1999

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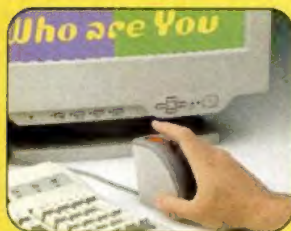
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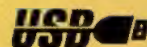
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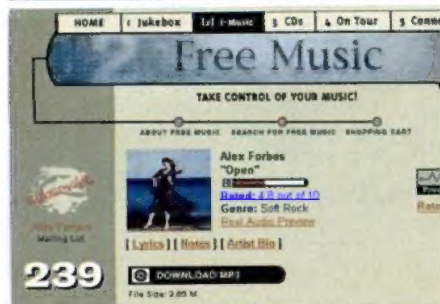


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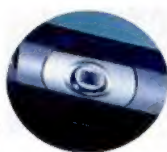
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The Internet changes everything. That's what I talked about last issue, and this past holiday season proved it, particularly when it came to shopping over the Web. Electronic commerce grew much faster than even the most optimistic Internet observers predicted this holiday season. Many sites, such as

Amazon.com, reported e-commerce sales that were four times last year's level. Just a year ago, only a few of us "early adopters" seemed to be actually spending our money online. Now it seems as if everyone is.

Already, there's very little limit to what you can buy online. Books and music were early items at places like Amazon.com; computer hardware, software, and networking products soon followed, led by online pioneers Dell and Cisco. Now you can find everything from consumer electronics to travel items to clothes. But just plain shopping online is only the tip of the iceberg.

Another recent online success is the tremendous growth of auction sites. Some of these sites, such as FirstAuction and Onsale, sell products themselves to the highest bidders. But others, such as eBay, let users bid on products owned and put up for sale by other users. Auction sites are letting all comers set their own prices—what they want for an item and what they are willing to pay. The result is a huge inventory of all sorts of products, from equipment to collectibles. In some ways, it's just like classified advertising, only faster and on a national scale. In many ways, it's pure capitalism.

But this concept can apply to many other kinds of businesses as well. Airlines have long sold tickets on the same flight for different prices, depending on such factors as when you booked. Now more Web sites are trying the same thing, starting with plane tickets and branching out into hotel rooms, with more to come. Priceline may have started the trend, but others are following, such as Airfare.com and Haggglezone.

With all this information on the prices of individual products on the Web, all it takes is an intelligent program to sort through and find the best price. A variety of sites now offer such programs, called agents, software robots, or bots. The best and broadest of these that I've seen are Shop the Web (formerly Junglee) on Amazon.com, Excite Shopping (formerly

Jango), compare.net, and MySimon. In addition, there are many specialized bots—particularly for those looking for computer equipment—such as KillerApp and ZD's own computershopper.com.

The ability to find the lowest price at any given time will cut the margins for people selling products unless they can add special services. Many sites are trying just that, offering either unique products or personalized information, such as recording your preferences. And people's ability to haggle over prices and bid against each other may force some prices down for things in great supply, just as it may force prices up for things that are scarce.

But the Internet is clearly going to change the way people shop and how much people pay for things. It will lead to much more volatility in pricing than we are used to seeing. Just look at the stock market and the amazing highs and lows it records, even during the day. "Day trading" on the Internet has led to lots of volatility in the market. (Don't ask me to explain the valuations of Internet stocks, though.)

In short, all this technology is changing the process of shopping and pricing. Hagglng and negotiation are becoming the norm. And the era of fixed prices may well be coming to an end, replaced with pricing that changes constantly.

At *PC Magazine*, we've been covering the Internet for years—since before there was a World Wide Web. It's time to make that an explicit part of our mission, however, and to make that clear we've changed our tag line to "The Independent Guide to Personal Computing and the Internet." You'll also notice a redesigned table of contents, which should make navigating the magazine easier, and new "Editors' Hot Links" in most feature stories will highlight the best links related to the products and services we are covering.

The Internet changes everything, and *PC Magazine* is no exception. **PC**



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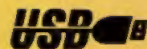
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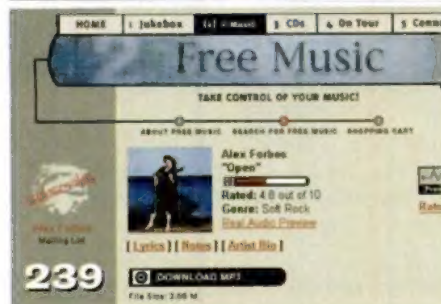
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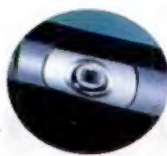
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Until recently, you had to choose flat out between power and price in buying a notebook PC. But new chips from AMD and Intel mean you don't have to give up quite so much speed to buy something affordable. *By Cade Metz*

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PC Magazine Labs has seen it all and now gives you nine pages of great tips and tricks. Here's how to print painlessly and improve your Internet connection, avoid crashes, and customize your Windows desktop.

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With nods to both Palm and Windows CE devices, here's our first roundup of software made just for hand-held computing. We cover productivity, communications, utilities, data entry, mapping, and games. *By Marge Brown*

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160 Ready for Biometrics?

They won't be delivered by Q in a black briefcase, but these new biometric security devices are the real deal. Truly practical choices for securing PC networks, they're arriving at just the right time. *By Gary Gunnerson*

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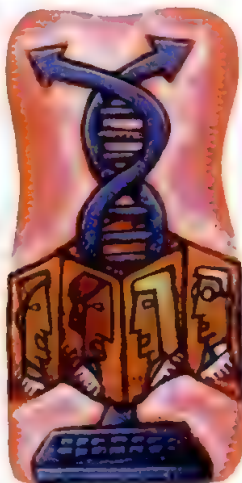
Bioinformatics Bonanza

Cross biology with information technology and what do you get? Bioinformatics, of course. This emerging field is turning out to be one of the hottest new career areas, fueled by major gene-sequencing projects now underway, which are creating a demand for experts who understand both biology and computing and can interpret the vast amount of data this type of research generates. The Human Genome Project, for example, will yield data on 3 billion DNA sequences.

Rensselaer Polytechnic Institute is at the forefront of training future scientists in this discipline, and it's one of the first universities to offer a bachelor of science degree in bioinformatics and molecular biology. Funded by a recent \$1.6 million grant from the Howard Hughes Medical Institute, the

program offers a solid grounding in molecular biology as well as database design, data mining, and the development of new algorithms and methods of analysis. New courses cover drug discovery, protein folding, and bioinformatics.

"The huge stockpiles of data on cells, chemicals, microbes, proteins, and DNA sequences are mere bits and bytes until they are turned into usable information by scientists with a solid background in bioinformatics," says Sandra Nierzwicki-Bauer, professor and chair of biology at Rensselaer. The department is also developing a program leading to a nonthesis master's degree in bioinformatics, to attract professionals in the pharmaceutical and computing industries. Nierzwicki-Bauer adds, "There's a large demand out there now and in the foreseeable future."



Betting on Biochips

The Human Genome Project—the government-backed effort to sequence DNA and gene structures—has moved into high gear, and computing technologies are becoming more critical to the project's goals. "Being able to understand the human genome and the world's diseases: This is entirely within our grasp within the next two decades," said Bill Gates, a biotech investor himself, in a recent address.

Technology companies are pitching in. Motorola is working with the U.S. government's Argonne National Laboratory to mass-produce biochips. Like the chip in your PC, which is designed to crunch millions of numbers in a split second, a biochip crunches millions of biological reactions in a split second.

A biochip incorporates tens of thousands of microscopic structures into a glass surface about the size of a glass slide that you would put under a microscope. Each microscopic structure functions as a tiny test tube. For example, hundreds of proteins found in the human body might be aimed at hundreds of these tiny test tubes, to see quickly how different proteins react to different types of DNA.

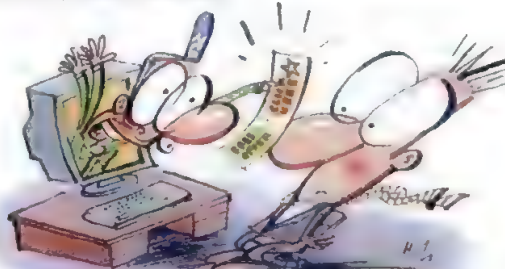
36% of respondents to a recent PC Magazine Online poll told us they expected to spend much more time online in 1999 than they had in 1998. Another 31 percent expected to spend a little more time, while 28 percent expected to spend the same amount of time. Only 4 percent expected to spend less time online this year.



Sticky Ads

Don't be surprised if advertisements start popping onto your screen the next time you use a shareware application. Shareware developers have discovered a new revenue-generating model that relies on ads and message sponsors, very similar to the kind strewn across Web sites today.

The catch is that these ads don't live on the Web. Rather, they make a home in the software itself. When you open and close various features of an application—the latest shareware version of PKZip, for example—ads that have been stored in the software's cache pop up in small windows. The next time you connect to the Web, software that's built into PKZip, called AdGateway, replenishes the old ads with new ones.



For advertisers—for whom eyeballs are the bottom line—AdGateway helps develop "sticky relationships with consumers," says Edwin Miller, vice president for marketing at Conducent Technologies, the developer of AdGateway. "AdGateway works both when you're online and off-line," he says, "so the relationship between advertisers and consumers is maintained even when you're not connected to the Web."

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**The Newest,
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Tangerine Apples

Apple hit it big with the racy iMac system and has just delivered the next generation. According to interim chief Steve Jobs, 1,365 new apps have been developed since the iMac's release, and the company sells one system every 15 seconds.

The new iMacs have 266-MHz G3 processors and are available in five colors—blueberry, strawberry, tangerine, grape, and lime. Apple has cut the price of the iMac to \$1,199—a \$100 savings.

Apple has also developed a line of Power Macintosh G3 systems—including a 400-MHz desktop—designed for 3-D graphics and multimedia. The new machines will incorporate FireWire technology for attaching multiple peripherals, as well as ATI Rage graphics accelerator cards. Prices range from \$1,599 to \$2,999.



And Graphics for All

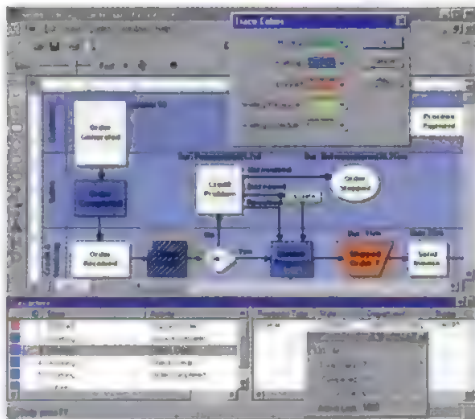
Micrografx, a longtime player in a variety of graphics markets, has recognized that corporations need the same sort of infrastructure for graphics software as they do for any other product category.

Over the past couple of years, Micrografx has been quietly updating its existing products and acquiring others with the goal of providing a single-vendor solution for all of an organization's graphics needs, from designing and editing images and dia-

grams to modeling processes and charting network infrastructure.

In the next few months, Micrografx will roll out a complete revamp of its product line under the family name iGrafx System. Among its eight products are

iGrafx Share, a tool for centralized management of multimedia assets; iGrafx Business, for editing images and creating vector diagrams; and iGrafx ERP for mod-



SYSTEM CONTROL: Micrografx has folded its products into the iGrafx System, a complete infrastructure for corporate graphics.

eling business processes for SAP R/3. The diagramming tools will likely be the first to implement Microsoft Visual Basic for Applications 6.0. All of the products will be manageable with a common set of administration tools.



Visual Chat

Remember Worlds Inc.? The company was one of the first to see the immense popularity that Internet chat was likely to gain as the Web grew. But its idea for leveraging that popularity—letting people chat within three-dimensional rooms—never really took off. Now Worlds has overhauled its 3-D chat room offerings and has its eyes on the added bandwidth many people now have.

Worlds' new Ultimate 3-D Chat Plus is based on a proprietary 3-D browser (available at www.worlds.com) that lets you enter chat rooms where objects are represented in three dimensions. You choose your own representative from a gallery of more than 100 avatars capable of various behaviors, such as flying.

Chat rooms consume 26 percent of all time spent on the Internet, according to Myra Stark, senior vice president at Saatchi and Saatchi.

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- 2 IBM ThinkPad 600 PP233 (\$2,589)
- 3 Compaq Presario 1235 K266 (\$1,586)
- 4 Compaq Presario 1240 M266 (\$1,840)
- 5 IBM ThinkPad 600 PP300 (\$3,402)
- 6 IBM ThinkPad 380Z PP233 (\$2,125)
- 7 Toshiba Satellite 2515CDS M266 (\$1,299)
- 8 Compaq Armada 7800 PP266 (\$3,641)
- 9 IBM ThinkPad 770 PP266 (\$3,658)
- 10 Compaq Armada 1573DM M233 (\$1,523)

Source: ZD Market Intelligence
Data for December 1998

Tax Loophole

According to research from Austin Goolsbee, a prominent University of Chicago economics professor, if sales taxes were imposed on Web shopping purchases, spending would plummet by 30 percent. The study of 25,000 online shoppers also revealed that taxes would reduce the number of current Web shoppers by 25 percent. Goolsbee concluded that most e-shopping is done in locations that impose high sales taxes. Although Web purchases are tax-free for now, Congress will be able to consider legislating Web taxes in three years.



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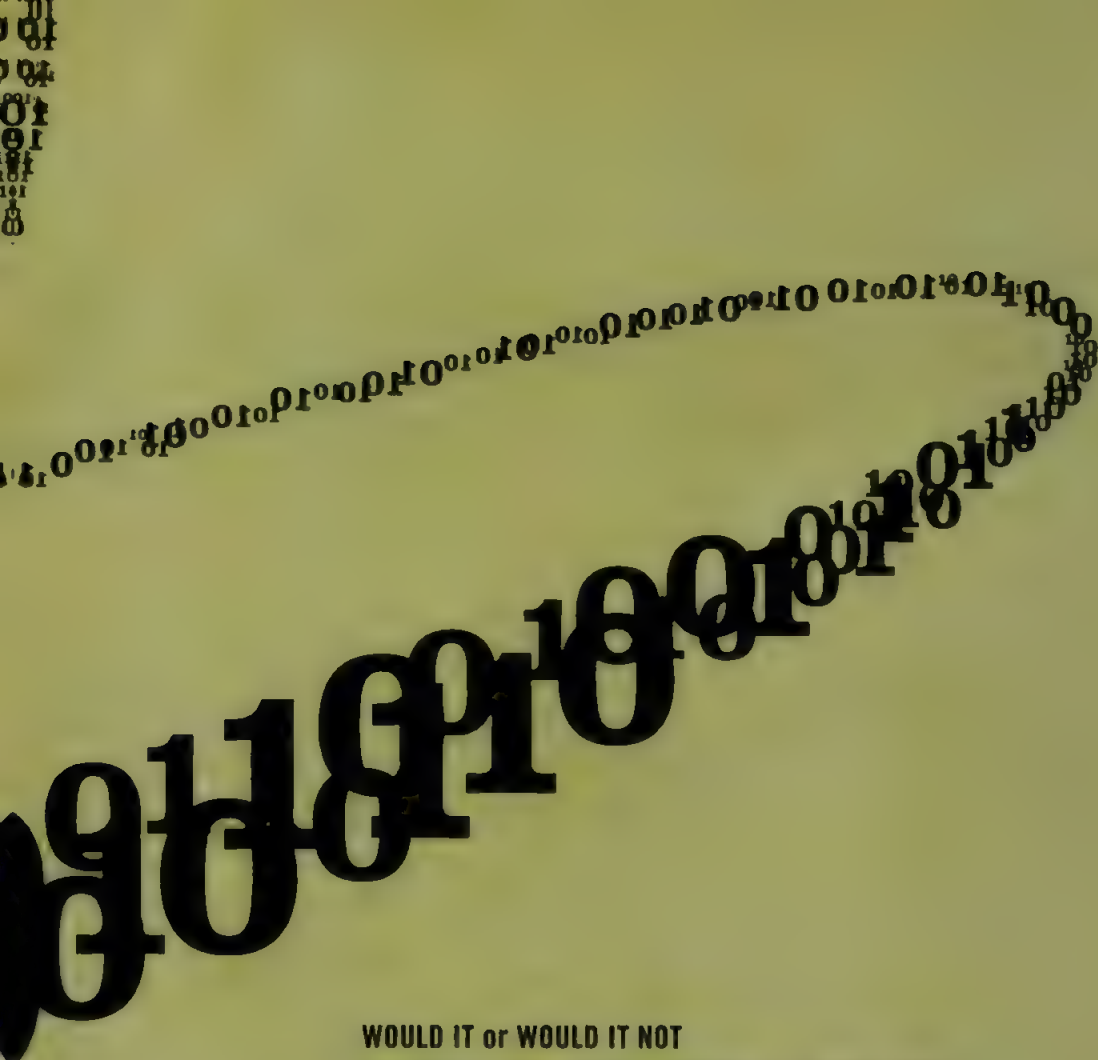
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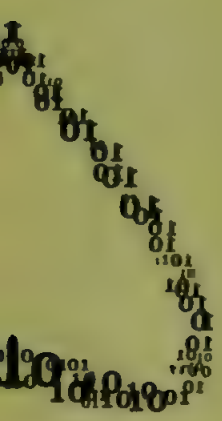


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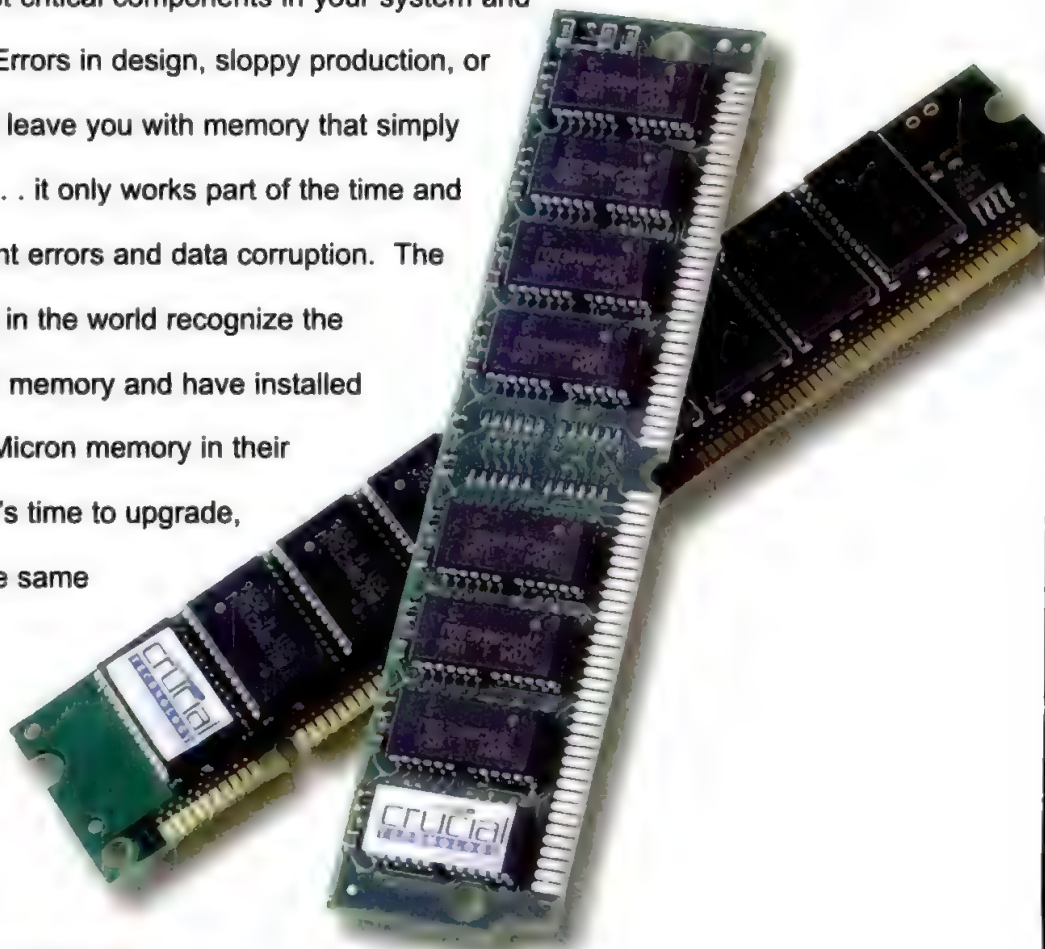
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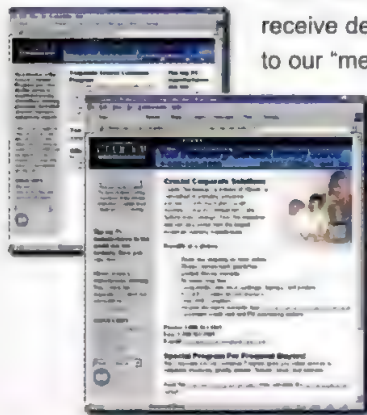
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LETTERS

THE PC YEAR IN REVIEW

I was very surprised at your choice of Netscape Communicator 4.5 as best browser in your story "The Best Products of 1998" (January 5, 1999). As a Web developer, perhaps I have a different perspective, but there are some very basic features that IE includes and Netscape Navigator does not. One is ActiveX. At our data-intensive site, this is a very big issue. There is not a report generator out there that does not use ActiveX. There is a Netscape plug-in for ActiveX, but I've tried to install it three times on three different machines, and it crashes Communicator every time. Also, Netscape does not do tables well, and with a data-intensive site, tables are its bread and butter. Word wrapping also works better in IE. If a table is wider than the browser, IE will try to stack the fields to fit in the browser space; Netscape, on the other hand, will actually overwrite the next field unless the programmer takes precautions to prevent this.

Before I started developing Web pages, I wholeheartedly supported Netscape Communicator/Navigator. Now I think it's an inferior product.

CHUCK CONOVER
via the Internet

I was disappointed not to see Sony's VAIO PCG-505 subnotebook series included in your best-of-the-year product roundup. It is a remarkable machine not merely for its compact features but, more important, for its matching lightweight price. The Toshiba Portégé 7000CT is inexpensive only because of Sony's aggressive pricing.

The other interesting thing about the VAIO PCG-505 is that it eschews using the latest Pentium II chip set. The tried and tested mobile Pentium/233 with 32MB of RAM runs Windows 98 more than adequately well. Technology for technology's sake is redundant if consumers really don't need it. In England, we call this *format fatigue*. And if anyone doesn't understand how people get fed up with competing technologies, just ask Sony about DAT or Beta videotapes. So, chaps, let's see a bit of credit where credit is due.

NICHOLAS DRUMMOND
Chelsea, London, England

OUT OF SITE!

What is the opposite of an Internet "flame"? Well, this letter is. I have just spent the better half of a day trying to install Direct Cable Connection, the Windows 95 utility for hooking up two machines. With not much success on my own, I turned to Microsoft's Web site. After a considerable amount of time, I gave

The one question I had, missing from all other

sources, was answered there. Excellent site!
WAYNE NEWBRE
via the Internet

My retired husband was asked to head a committee, and guess who is his de facto secretary? I just downloaded RoboType 2 and want to let you know how much I appreciate it. I have tried downloading utilities that were discussed in *PC Magazine*. They simply did not work for me, maybe because of my lack of know-how. But this one sounded like just what I had been looking for, so I took the chance and am so glad I did. It took me about 5 minutes to download, another 5 to install and read the directions, and in another 5 minutes I had the program up and running. Your program types "U.S./Mexico Bi-National Tuberculosis & Brucellosis Eradication Committee" automatically. My fingers thank you!

ANITA JOHNSON
via the Internet

A VIEW OF THE PREVIEW

The most telling statement in your review of the Microsoft Office 2000 preview package (First Looks, January 5) is "Since Office 2000 is so deeply intertwined with the OS, test it only if you plan to reformat your hard disk afterward." The benefits of tightly integrating applications, including Internet

Technology for its own sake is redundant if consumers don't need it.

browsers, with the OS are obvious; that is, the benefits to Microsoft are obvious. Such integration makes users more dependent on Microsoft and therefore less likely to buy any type of software from other vendors.

What is much less obvious is how this integration benefits users in any way. Microsoft is doing a huge disservice to computer users by creating a more complex set of interdependencies between applications and operating systems with each new product revision. Imagine the catastrophic possibilities as this trend continues with Windows 2000, featuring Active Directory and IntelliMirroring. I can just hear the Microsoft help desk technicians now: "I'm sorry, sir, but it looks as if your only option is to reinstall your entire network."

KIRCHNER'S RESOLUTIONS

I agree with a couple of Jake Kirchner's points in "A Self-Improvement Plan" (January 5), but I had to laugh at his complaining about bandwidth. Down here at ground level, where most of us live, monthly fees of \$40 and up for cable or DSL Internet access are the real impediments. I use Access 1, a 56K modem, a Web page-caching utility, TweakDUN, and multiple browser windows, and the Internet works just fine for me.

RICHARD DAVIES
via the Internet

SOME REALLY GOOD IDEAS

Recently, John C. Dvorak opined that at present, electronic books aren't viable ("The Next Really Bad Idea," December 1). I agree that for most uses they aren't; if you have a paperback and lose it, you haven't lost much. And there is something about the feel and smell of paper and ink. But I do believe he missed at least two good uses: First, an e-book could replace several pounds of old-style textbooks that are outdated the moment they are printed. It could be updated continually; costs to students could be lower; there would be less waste of paper and ink; and several texts could be loaded on the same reader. A second use may be

Braille books. It might be possible to create raised dots instead of pixels on a screen. Books that aren't converted to Braille today because of the expense would be available, and they'd be more compact than Braille volumes.

JIM FUDGE
via the Internet

A CORPORATE OPINION

Your story "The Best PC" (December 1) was, as usual,

thorough and informative. Over the years, I have come to rely greatly on the expertise of the *PC Magazine* staff. However, when selecting the best corporate PC, I believe you overlooked one very important fact. In awarding the Compaq Deskpro EN 450 your Editor's Choice, you selected a PC that utilizes a proprietary BIOS that "translates" hard disk parameters as it sees fit. Overriding the auto-configure feature is not possible.

What all this means is that one cannot exchange hard disks between Compaq machines and those that use a standard BIOS (such as Phoenix, Award, and AMI). Virtually



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- Creative Labs 128 PCI Sound
- #9 Revolution 4 32MB AGP Video
- Q (2) 9GB 10,000RPM LVD 5 Dms.
- Removable HD
- AMI 466 Ultra 2 LVD Raid 0-5 Controller
- Sony 32x CD-ROM. Keyboard. Floppy. Mouse
- Tower Case 300 Watts

4613

Aerial Galaxy 52MB Dual Port Video - 300

POWER STATION

- 1 Intel Pentium II 450MHz Processor
- 512KB Cache. Upgradeable to 2 CPUs
- 64MB SDRAM
- Slots: (5) PCI (2) ISA (1) AGP BX Chipset
- IBM 10GB 7200 RPM Ultra-33
- Sony 32x CD-ROM
- NEW! Diamond N Video 16MB TNT AGP Video
- Keyboard. Floppy. Mouse
- Mid Tower Chassis

1650

4GB LVD 10000RPM Solution - 2550
Full Upgradeable

- 1 Intel Xeon 400MHz Processor
- 512KB Cache. Expandable to 2 CPUs
- 128MB SDRAM. Expandable to 2GB
- Slots: (6) PCI (1) ISA (1) AGP
- Sound and Ethernet 10/100 by Intel
- #9 Revolution IV 32MB AGP 2X Video
- IBM 14GB 7200RPM IDE Removable HD
- Sony 4x2x CD Recorder
- Keyboard. Floppy. Mouse
- Full Tower 300 Watts

2547

4GB LVD 10000RPM Solution - 3744

- 1 Intel Celeron 333MHz CPU
- 128KB Cache
- 32MB SDRAM
- Integrated:
Creative Labs PCI Sound
BMB N Video 128 AGP Video
- 4GB Ultra 33 HD
- Slots: (3) PCI (3) ISA
- Sony 32x CD-ROM. Keyboard. Floppy. Mouse
- Surround Sound Speakers
- Desktop Chassis
- Intel Landesk Client Manager

693

- 1 Intel Pentium II Xeon 350MHz CPU
- 512KB Cache
- 64MB SDRAM
- Slots: (3) PCI (2) ISA (1) AGP
- 6GB Ultra HD
- Sony 5x DVD CD-ROM
- Real 3D Starfighter BMB AGP
- Sound with Subwoofer Speakers
- Keyboard. Floppy. Mouse
- Desktop Case

1057

SAMPLE SERVERS



SIF QUAD XEON 450MHz - POWER

- (1) Intel Xeon 450MHz Processor
- 512MB Cache. Expandable to 4 CPUs
- 256MB ECC Memory. Expand to 4GB
- Slots: (7) PCI (1) ISA • Integrated 2MB Video
- Integrated Dual Ultra 2 LVD SCSI Controllers
- 3 Chan Ultra 2 LVD Raid Cont. w/ 64MB Cache
- Q (3) 9GB 10,000RPM 5 Dms. Xeon HD
- Intel Server Adaptor
- EMP Port for Remote Server Management
- Server Management System On-board
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Redundant Solution Available

SIF DUAL PU MIRRORRED RAID SOLUTION

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- 128MB ECC Memory. Expandable to 1GB
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- Integrated Adapter LVD SCSI
- Integrated 2MB Video
- Intel Server Mgt. Hardware
- Single Channel Ultra2 LVD RAID Controller w/ 16MB Cache
- Q (2) 9GB 10000 RPM LVD 5 Dms. Removable HD
- 12 24GB Seagate 4mm DAT Tape Drive
- Sony 32x CD-ROM. Keyboard. Floppy. Mouse
- Full Tower 300 Watt

4700

SIF DUAL SLOT 2 XEON 400MHz RAID 5

- 1 Intel Pentium II Xeon 450MHz Processor
- 512KB Cache. Expandable to 2 CPUs
- 256MB SDRAM. Expandable to 2GB
- Slots: (6) PCI (1) ISA (1) AGP
- Integrated 10/100 Ethernet & Sound
- Matrox BMB G200 Video
- Q (3) 9GB 10,000RPM LVD (5 Dms)
- Removable HD
- 3 Channel LVD Raid 5 Controller w/ 16MB Cache
- Sony 32x CD-ROM. Keyboard. Floppy. Mouse
- 13 Bay Tower Chassis 400 Watt Redundant Hot Swap Power

7500

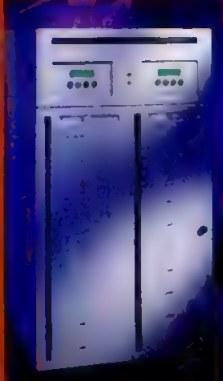
SIF DUAL XEON BACKMOUNT W/O SERVER

- (1) Intel XEON 400 Mhz Processor
- 512KB Cache. Expandable to 2 CPUs
- 128MB ECC Memory. Expandable to 2GB
- Slots: (6) PCI (1) ISA (1) AGP - 6X Chipset
- Integrated 10/100 Ethernet
- 9GB 10,000 RPM LVD (5 Dms)
- Removable HD
- Integrated Adapter 2940-U2W
- Sony 32x CD-ROM
- Keyboard. Floppy. Mouse
- Rackmount Chassis 300 Watt Power

3450



SAMPLE RAID SUBSYSTEMS



- 2 Channel RAID LVD Controller
- 8 Hot-Swappable Drive Bays
- 2 300 Watt N+1 Redundant Power Supplies
- 32MB Cache
- Internal Temperature Status
- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

27GB Solution
Q (3) 9GB 7200RPM LVD HD
6370

27GB Solution
Q (3) 9GB 10,000RPM 5 Dms LVD HD
6840

54GB Solution
Q (3) 18GB 10,000RPM LVD HD
8351

- Active-Active Controllers
- Q (2) 4 Channel RAID 5 LVD Controllers
- 8 230 Watt Hot Redundant Power Supplies
- 128MB of Cache
- Internal Temperature Status
- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

72GB Solution
Q (8) 9 1GB 7200RPM LVD HD
18,750

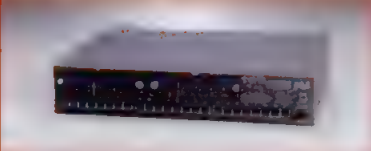
72GB Solution
Q (8) 9GB 10,000RPM 5 Dms LVD HD
20,300

144GB Solution
Q (8) 18GB 10,000RPM LVD HD
24,498

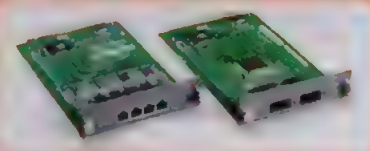
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to have in a support arsenal, as any good IS professional will tell you. Introducing this type of nonstandard PC into a corporate environment would be a nightmare. Wake on LAN and other DMI features are useful, but what good is knowing that your CPU is failing if you can't move the hard disk to a new machine? Unless, of course, you happen to have another Compaq sitting around.

With the rest of the industry using a standard and Compaq taking a proprietary approach, I would have eliminated Compaq from consideration as a corporate PC from the get-go.

HUGO FURTH
Manhattan Beach, California

DON'T SLIGHT AMD

As a long-time subscriber, I look to *PC Magazine* for trustworthy and unbiased reviews. Your recent quick dismissals in several feature articles of the AMD K6-2 line of processors, however, make me wonder.

The performance you get from, say, a K6-2/300 running on a 100-MHz motherboard with a decent L2 cache makes that processor an excellent alternative to the more expensive Intel processors. For many people who—let's face it—don't really need to shell out big bucks for a 450-MHz Pentium II, the AMD processors provide solid, fast performance for not a lot of money. The Intel Celeron line is what you should be telling people to avoid. I think you are doing your readers a disservice by telling them to look only to Intel when alternatives like the K6-2 line exist.

SCOTT FORDIN
via the Internet

IT'S A KID'S WEB

Your section on kids' search sites ("Find It on the Web," December 1) left out several excellent tools, including KidsClick! (sunsite.berkeley.edu/KidsClick/), StudyWeb (www.studyweb.com), SmartZone (home.edview.com/search), Awesome Library (www.awesomelibrary.org), and Education World (www.education-world.com). These are particularly strong for schoolwork assistance, in contrast to the sites mentioned in your story.

JERRY KUNTZ
via the Internet

THREE ON Y2K

Richard Dalin is probably correct in stating that the primary reason two-digit years were used in the sixties and seventies is that we did not realize that there was any reason not to do so (Letters, November 17). As a COBOL programmer from the mid-1960s, I certainly don't remember thinking that my code would still be running, or data generated from it still being used, in the impossibly remote year 2000. However, there were other constraints that Mr. Dalin does not mention. Tape data densities (bytes per inch) and data-transfer rates were very low, so keeping files as small as possible was desirable to reduce runtime. Although records were processed singly, they were blocked on the tape and read and written as blocks, so the core memory used by a few extra bytes in a tape record often was multiplied by twice the number of records in the block (once in the input area and once in the output area of core). Probably more important was that the universal input medium then was punched cards. An IBM-format card had space for 80 characters, and you had to cram as much information on a card as possible.

TOM GLEASON
via the Internet

Global economic recession, banking failures, Fortune 500 companies declaring bankruptcy, government shutdowns, drastic reductions in air travel, power failures, water-plant failures, telecommunications failures, food shortages, death: These are all potential consequences of the Y2K bug. Yet in his latest column ("The Looming E-Mail Disaster," January 5), John C. Dvorak states that security holes in the e-mail architecture are more dangerous than Y2K. Is he insane?

ALEX VAN DER HENGST
via the Internet

Though the continued articles and related paranoia regarding the upcoming Y2K disaster are helpful to our society, I am truly amazed at the shortsightedness of everyone involved. We will spend billions of dollars to fix code to just four places, but what happens after December 31, 9999? Wake up, program-

mers; these quick fixes are what give you guys a bad name. Only 8,000 years to go, and the clock's running. Think Y10K!

CHRISTOPHER GUND
via the Internet

MORE FIRST LOOKS

I just wanted to drop you a line about how much I like the expanded First Looks section in *PC Magazine's* print issue and online. Keep up the good work!

DAVE BROCCARDO
via the Internet

PALM PROPHECIES

I think the major limitation of Palm devices is their lack of universality. The 3Com Palm III, for instance, has an infrared port for sharing information with other Palm devices. But what about communicating with other devices?

Wouldn't be great if you could beam a grocery list into a shopping cart's on-board computer, which would have a display to show you in which aisles all the items are located? When you hit the checkout line, the cash register could beam the itemized receipts and grand totals to your Palm III for easy logging into your expense app.

Public pay phones could have infrared ports, so you could beam a telephone number from your Palm III to the phone, which then would dial it. Your calling-card number could be securely encrypted and beamed to the pay phone. If you needed directory assistance, the operator could beam the number and address to your Palm directly.

GARY PIEN
Providence, Rhode Island

NOT MAD ABOUT ADS

As a consumer, I understand the need for advertisements. The newest trend in *PC Magazine* and the driving force behind this letter is the heavy card-stock pages, either as a single "here's the beginning of our spread" page or used for an entire ad. My gripe is not with the ads themselves but with their effect on the rest of the publication. I tend to read through each issue many times, picking different articles each time. The card-stock ads make it nigh-on impossible simply to thumb through the pages to one particular page. And what if you should actually want to lay the issue flat and read an article that's in close proximity to one of the monsters? Rip it out? Sure, if you don't mind disassembling the entire magazine. Entice me with prices, quality, or service, not paper weight.

JEFFREY S. HARKAVY
Hillsborough, North Carolina

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Glitzy Chips

In 1999, graphics and multimedia acceleration will take center stage, with AMD and Intel rollouts imminent.



One of the key technology competitions for 1999 promises to be the race to deliver desktop PC chips with muscular new multimedia acceleration features. Advanced Micro Devices (AMD) and Intel are both focused on that goal, and the first half of this year will bring a flurry of new multimedia-smart offerings. At both the low and high ends, as we approach the new millennium, the prospects for marquee-level microprocessors will revolve around how they handle advanced graphics and multimedia.

AMD is ramping up to deliver a new version of its K6 microprocessor in this first quarter. It's code-named Sharptooth and officially dubbed the K6-3. According to some early reports, the 450-MHz K6-3 chip may outperform the Intel 450-MHz Pentium II and the Intel Celeron 450A. The K6-3's release will be timed very near to the release of the Intel Pentium III chip, which will incorporate the new Katmai multimedia instruction set. Both K6-3 and Katmai technologies are customized to speed up the performance of multimedia applications.

The new AMD chip grabbed headlines recently when a Web site called AnandTech published preliminary benchmark tests purported to have been run with a prototype of the K6-3. These test results showed that a prototype of the K6-3 chip outperformed both the 450-MHz Pentium II and the Celeron 450A microproces-

sors when running graphical applications.

As has been the case with its 3DNow! multimedia instruction set, AMD remains focused on differentiating its chips by accelerating graphics and multimedia with new multimedia instruction sets. That will be a primary focus as AMD rolls out the much-awaited K7 chip in the first half of this year. The K7 is expected to start at 500-MHz speeds, ramping up quickly to 1 GHz. Both consumer and high-end versions of it will appear, with the

computing platforms that deliver a near-theater-quality experience."

THE PENTIUM III

Intel's own plans for its line of 32-bit processors in 1999 and 2000 are ambitious, and as the new millennium starts, it will also start the transition to 64-bit chips, beginning with its Merced processor. The company is planning to ship its Pentium III chip, formerly code-named Tanner—a 500-MHz processor with the Katmai instructions—by the beginning of the second quarter of 1999. Unlike the company's MMX technology, which is limited to integer-based calculations, Katmai will deal mainly with 3-D rendering and other floating-point operations.

Tanner will be followed by another chip, Cascades, based on the Katmai Instructions. Then, in 2000, Intel plans to deliver a super-pipelined chip with an entirely new 32-bit core that will be capable of 1-GHz clock speeds. Code-named Foster, it will be aimed initially at workstations and servers. A second version of Foster, Willamette, is due in 2001 and is targeted to replace the Pentium II in desktops.

Even as AMD and Intel race for pieces of the graphics- and multimedia-acceleration pie, the question remains: Can desktop PC software catch up? AMD, for example, has had success with its 3DNow! effort in attracting buyers of low-end game machines, and such buyers remain the bulk of the market for advanced 3-D designs. Likewise, Intel's Xeon effort has helped the company make a success of its foray into producing chips for PC workstation platforms.

But the history of games and advanced graphical applications on the PC platform has

"In 1999, new AMD 3-D technology will distinguish us from Intel and lead the way to visual computing platforms that deliver a near-theater-quality experience."

—W. J. Sanders III, AMD Chairman

"We see future applications as full of rich data-types—such as graphics, audio, and speech—both for clients and for servers."

—Albert Yu, Senior Vice President, Intel's Microprocessor Group

high-end flavors featuring L2 cache. AMD's 3dNow! architecture will be central in the K7.

According to AMD chairman W.J. Sanders III, 1999 will be a critical year for AMD's 3-D-boosting efforts. "In 1999," he says, "new AMD 3-D technology will be delivered, and it will give us an opportunity to distinguish ourselves from Intel and lead the way to visual

shown that these niche applications—and the chips that power them—can have a powerful spillover effect on mainstream desktop computing. As 1999 and the new millennium unfold, we'll see if the software applications we use every day can keep up with the new multimedia-smart chips.—Sebastian Rupley

Money-Making Web Music

Now that the Recording Industry Association of America (RIAA), along with five of the biggest recording companies, has announced plans to develop a secure and profitable architecture for digital music distribution, the music industry is finally staking a claim in the digital economy. America Online, AT&T, IBM, Lucent, Matsushita, Microsoft, RealNetworks, Sony, and Toshiba are also backing the initiative.

Details about the effort, called the Secure Digital Music Initiative (SDMI), are scant, but what is known is that by this time next year, you'll be able to download music that will adhere to certain specifications, which the RIAA hopes to make as universally accepted as the specifications for compact disks.

The RIAA's move wasn't a moment too soon. The growing popularity of MPEG Audio Layer 3 (MP3)—a freely available CD-quality music compression and playback file format—is seen as a threat to the music industry's ability to protect copyrights online, although many sites legitimately distribute MP3 music files. (For details see "Net Tunes" in this issue's After Hours.) Free MP3 music files are available from hundreds of "Internet jukeboxes."

"It's not that the music industry is complaining about Internet piracy," says Hillary Rosen, chairwoman of the RIAA. "Our efforts are about creating positive changes and enabling a digital marketplace," she says. What will happen to MP3 in the wake of SDMI's emergence isn't clear. SDMI will also have to contend with two other established digital music formats: Liquid Audio and AT&T's a2b Music.

According to Diamond Multimedia, maker of the Diamond Rio PMP300 Portable Music Player, SDMI won't kill MP3. The company expects that at least two formats will coexist: MP3, which is inexpensive and ubiquitous, will be used by independent artists, while a high-security format (such as SDMI, a modified version of MP3, Liquid Audio, or other formats already on the market) will be used for valuable music from big labels.—*Angela Hickman*



Unless you're looking to buy the ultimate notebook performer, you don't need to spend the extra cash for a top-of-the-line processor. In fact, your money would be better spent on more memory and a hard disk with a faster rotational speed than on a processor that's one speed grade faster or even a slightly improved core at the same speed. After all, system performance is affected not only by the processor, but also by the amount of memory and speed of the hard disk.

For our feature story in this issue "The New Notebooks" PC Magazine Labs upgraded the processor of a Gateway Solo 2500SE from an Intel Pentium 233 with MMX to an Intel Pentium II 233. The Pentium 233 MMX chip included the CPU, 512KB of L2 cache, and the north bridge of the 430TX chip set. The north bridge contains power management support, IDE support for an Ultra DMA hard disk, USB support, and the PCI/ISA bridge. The Pentium II processor contains the CPU, 512KB of L2 cache, and the north bridge of the mobile 440BX chip set.

The processor swap doesn't increase the speed of the CPU, but it does upgrade the processor's core technology. The Pentium II offers dual-independent bus architecture that gives higher bandwidth to the cache and system logic. And the Pentium II's 512K of L2 cache runs at half the processor speed (116.5 MHz) compared with the 512K of L2 cache on the Pentium MMX, which runs at only 66 MHz.

These enhancements should have contributed to significant performance boosts on all our tests. Indeed, our CPUmark₃₂ tests showed a considerable increase—nearly 40 percent. Oddly though, our Winstone test—which exercises the entire system, including graphics, disk, and memory timings—increased by only 5 percent.

In order to get to the bottom of these unexpected results, we added memory to the Pentium 233 with MMX and ran our Business Winstone 99 benchmark test, which loads multiple office apps into memory and then runs one app at a time. Our Business Winstone tests showed a 25 percent increase in performance when we upgraded the system from 32MB to 64MB of memory. If you use your notebook this way, then you'll benefit from the additional memory.

After you've added memory, see if the vendor offers a hard disk with a faster rotational spin. While desktop IDE hard disks have progressed from 5,400 rpm to 7,200 rpm, notebook hard disks have progressed from 4,200 rpm (the speed of our Solo notebook) to 4,900 rpm. Slow disk speed affects all aspects of performance, including boot-up, reading from disk, and writing to disk.

The small performance gain on our Winstone tests was due to the fact that the 4,200-rpm hard disk was slow compared with the upgraded processor. Even with the faster processor, the hard disk couldn't read data from the platter any faster.

—*Rich Fisco*

Upgrade Scenarios

When we upgraded the processor of our Gateway Solo notebook, performance increased significantly on our CPU test but by a mere 5 percent on our Winstone tests, which measure performance when running business applications.

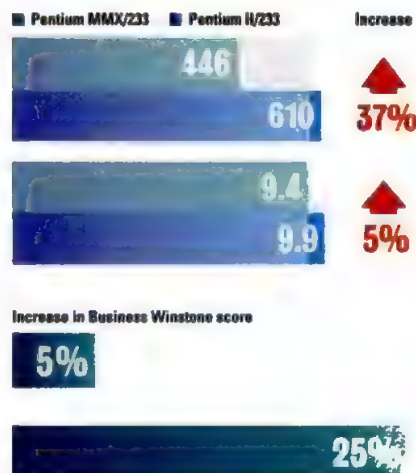
CPUmark₃₂

Business Winstone

Adding memory to our Gateway Solo notebook improved the Business Winstone score significantly more than upgrading the processor. If you run lots of business applications, a memory upgrade may be your best bet.

Processor upgrade:
Pentium MMX/233
to Pentium II/233

Memory upgrade
(with Pentium
MMX/233):
32MB to 64MB



Smart Video Searching

Whether delivered via cable TV, DVD disks, a corporate intranet, or the Web, video is a ubiquitous presence in our daily lives. But this increased volume has proved to be a nightmare for producers, who must still edit video manually—scrubbing through raw footage, trimming clips, and splicing significant scenes together.

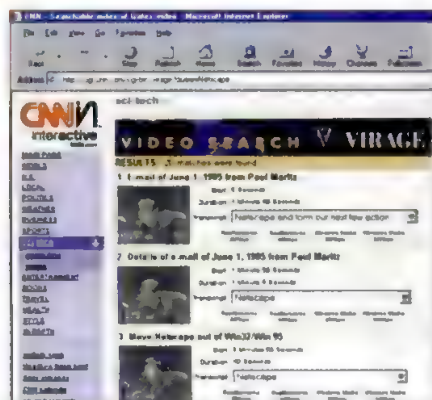
Viewing video is also essentially an unchanged experience, and a passive one. With the exception of the fast-forward button, the video consumer has little control over playback. While this system works well enough for the entertainment industry, it has drawbacks when video is used as an information medium.

Software developer Virage hopes to meet the needs of both video producers and consumers with VideoLogger, automated cataloging software that literally watches and reads

a video in real time. Image analysis algorithms use significant visual shifts (such as cuts, pans, or zooms) to identify individual scenes automatically and create indexed keyframes. Simultaneously, VideoLogger extracts embedded textual data, which can include SMPTE timecode, lineup files, and closed captions. When synchronized with a digital video stream, this searchable, frame-accurate index provides nonlinear access to any point of interest within the video.

VideoLogger has moved quickly into corporate enterprises. "The fastest-growing segment of our client base is the Fortune 1000," says Carlos Montalvo, vice president of marketing at Virage. According to market research firm Frost & Sullivan, video-cataloging software sales will increase from \$11 million in 1998 to \$29 million in 1999.

Virage has announced a slew of product en-



THE TAPES: With Virage VideoLogger, CNN Interactive offers searchable video.

hancements designed to parse video in ever more intelligent ways. In a joint development with IBM, VideoLogger will convert spoken words into text and identify the audio signatures of up to 300 speakers. In the next 6 to 12 months, VideoLogger will support face and optical character recognition.—Luisa Simone

The Entrepreneurial Bone

By now you've heard the story about how Michael Dell started his mail-order PC company in his college dorm room at the University of Texas and went on to grow it into the \$18 billion industry leader it is today.

What you probably don't know is that Dell arrived at the university in a BMW he had bought with money he'd made selling newspaper subscriptions as a teenager, for a mail-based solicitation business he'd built up in his spare time. Oh, and that BMW had three PCs in its trunk. Seems that several years earlier, Dell had realized the business potential inherent in selling for \$3,000 a customized IBM PC that required only \$600 to \$700 worth of components to make.

Michael Dell, it appears, was born a businessman. If he wasn't born with an entrepreneurial bone, he grew one rather quickly. By the time he was 12 he was making thousands of dollars in mail-order sales to stamp collectors. By age 18 he was telling people his ambition in life was to compete with IBM. Today, a lot of folks at IBM have the ambition of competing with Dell.

In his soon-to-be-released book, *Direct from Dell: Strategies That Revolutionized an Industry* (Harper-Business, \$25), Michael Dell recounts that by the middle of his freshman year in college, he was selling \$50,000 to \$80,000 a month in PCs, upgrade kits, and components to people in the Austin area. By the end of that year, 1984, he had incorporated his company and moved it into an office building. The rest is computer industry history, a history Dell lays out in detail in his book.

The book, like many by successful corporate CEOs,

tells us more about Dell himself and the history of his company than it does about how to build a Fortune 500 enterprise. Anyone interested in the PC business will find the book fascinating for that personal perspective and company history.

I found the book refreshingly free of hubris. Dell details with pride the accomplishments of his company and clearly relishes beating larger competitors. Most of all, he loves proving his critics wrong. But he spreads the credit broadly, noting the contributions of his coworkers and fellow Dell Computer execs.

More important, he outlines the mistakes the company had to overcome along the way. And some of them were significant: accumulating excess inventory, growing too quickly by entering markets Dell was not equipped to serve reliably, experimenting with retail sales, and at times trying to push technology the company's customers didn't need or want. Dell's exhortations to learn from one's mistakes are obviously heartfelt.

As a pure business book, this one is less than satisfying. Dell is clear in his advice to listen to your customers, partner closely with suppliers, hire good people, believe in yourself, and take advantage of the Internet. But his descriptions of how those dicta play out at Dell Computer are rather sketchy, too much so to make this any sort of textbook on how to build your own successful company.

But the book is a short one, just slightly more than 200 pages, so it will be a quick read for your next business flight. Besides, your success won't come from any book. As Dell writes: "You don't have to be a genius, or a visionary, or even a college graduate" to be successful; "you just need a framework and a dream."



Jake Kirchner

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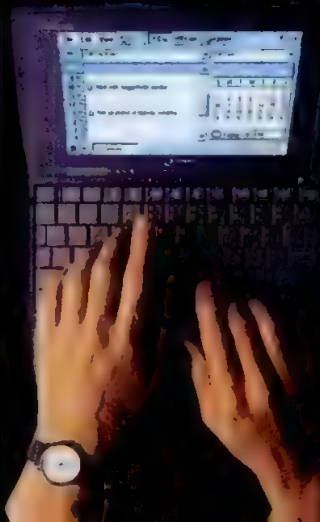
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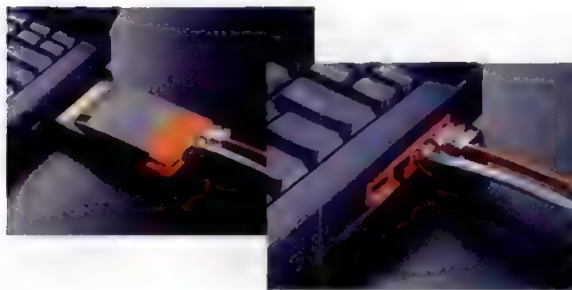
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The Infra-Com Red Beamer establishes a wireless infrared connection from a phone outlet to a transceiver located atop an Internet TV, PC, or notebook. Unlike conventional infrared technology—which requires a direct line of sight—the Red Beamer uses omnidirectional infrared light (it's safe), which fills the room and bounces off walls, ceilings, floors, and objects, until it reaches its partner. The technology works within a radius of 8.5 yards. Future applications may include wireless keyboards and toys.



INTERNET

The Web, Now in Infrared

Having Web access in your home may have impressed the neighbors a few years ago, but how gauche to boast about it today, now that over half of all U.S. homes with PCs are connected to the Web. Say you have *wireless* Web connections inside your home and that's a different story.

Wireless home networking products based on radio-frequency technology are available now from companies such as Diamond Multimedia and Philips. And wireless hand-helds such as the Cyrix WebPal let you walk about with the Web as well. Phone-line networking is also making a splash, but it requires that you tether yourself to a phone jack. Israel-based start-up Infra-Com has developed a wireless technology based on infrared (IR) light that gives you some mobility at a low cost.

The approach is similar to the use of IR in your TV remote control, but with a twist. Engineers at Infra-Com have come up with IrGate, an omnidirectional IR technology that doesn't require an unobstructed line of sight between two transceivers. Instead the *diffuse* IR light emitted from a transceiver connected to the phone jack is reflected off walls, ceilings, floors, objects, people, and pets in its journey to find its partner, which is located atop an Internet TV, desktop, notebook, or hand-held.

The connection between the units is carried out through broadcasting and reception of split infrared rays. The Red Beamer works within a radius of 5 meters and reaches speeds up to 56 Kbps. Four devices can operate simultaneously in the same room.

The result: You don't need to position your Internet TV or computer next to a

plans to develop and produce its own chip sets for other applications. Shown recently at the Demo conference, an exclusive annual showcase of new technologies, the Infra-Com Red Beamer will show up in the second quarter of the year for about \$100.

Infra-Com's technology isn't the only wireless approach vying for attention. Bluetooth is an RF-based wireless communications link that developers are supporting as an industry-standard way for digital devices to communicate wirelessly. But Infra-Com CEO Yaron Ruziak sees the phone wire as the real challenger. "Our competitor is the phone wire, then Bluetooth," says Ruziak. Future applications of IrGate may include wireless keyboards and toys.—Carol Levin

DIGITAL VOICE RECORDERS

The Next Wave

You have to admit, sometimes it's just quicker and easier to tell someone what's on your mind than to jot your thoughts down on paper or compose an e-mail message. That's why the hand-held digital voice recorder is making a splash on the market and may soon find its way into your panoply of portable palm-size peripherals. The latest models offer speech recognition software for voice-to-text conversion, and future models promise advanced features that will identify multiple recorded voices.

Olympus's digital voice recorder—the D1000—comes standard with IBM's Via-Voice Transcription, a customized version of the voice recognition software IBM ViaVoice. After you finish dictating into the recorder, which stores digital audio on a Flash Memory Miniature Card, you can transfer the file to your PC, where ViaVoice converts the recorded voice into text.

Similarly, Dragon Systems' Dragon NaturallySpeaking Mobile lets you upload audio files via serial cable to your computer, then have them automatically transcribed. Sony,



WHAT'S NEXT? Sony and IBM are working on advanced voice recognition for future models.

recording devices, hasn't yet integrated speech-to-text functionality into its line of products (including its latest model, the ICD-80PC Voice File), but the company is working with IBM on integrating voice-to-text features into future models.

Software that can identify multiple speakers is the next step for these devices. Known as speaker-independence, this technology will enable identifying all of the participants in a recorded conversation by their unique voices. Researchers at IBM have already demonstrated technology in this arena. IBM's Voice-Print is a speaker recognition technology that's able to identify a speaker based on any words



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ULTRAPORTABLES

The New Featherweights

Once easily discernible, the distinction between notebook PC and hand-held PC is now less clear. Ostensible hand-helds such as the HP Jornada, which runs the simplified operating system Windows CE, are actually larger and heavier than squat mini-notebooks such as the Toshiba Libretto, which runs Windows 98. Deciding on a portable PC—balancing size against performance, weight against battery life—is an epic task.

Soon it will become even more difficult. In February, Fujitsu will improve on the Libretto's basic design with the Fujitsu LifeBook B112, a 2.4-pound Windows 98 machine equipped with a 233-MHz Pentium MMX chip, 32MB of RAM, 512K of L2 cache, and an 8.4-inch active-matrix display that can be navigated by touch. Later this year, the new Sony VAIO PCG-C1 mini-notebook—a slightly smaller, multimedia-centric machine that has already reached Japan—will arrive stateside. In addition to a 233-MHz Pentium MMX, 64MB of RAM, 256K of L2 cache, and a common 8.9-inch TFT display, it provides an integrated CCD camera that captures both still and moving images.

Those wishing to spend a bit less and preferring to navigate Windows by touch will be better served by the LifeBook, priced at \$1,599. But the VAIO PCG-C1—now selling in Japan for around \$2,000—is the more enticing product, expanding on the VAIO line's audio/visual offerings despite its diminutive chassis.

Sizes, weights, and batteries: Built much like the Libretto, the VAIO PCG-C1 measures 1.5 by 9.5 by 5.5 inches (HWD) and weighs just 2.3 pounds, resembling a slightly elongated paperback novel. The LifeBook is much deeper (6.9 inches) but also thinner (1.1 inches) and less wide (9 inches).

SONY VAIO PCG-C1

www.ita.sel.sony.com

- Built-in motion camera
- 2.3 pounds
- 1.5 by 9.5 by 5.5 inches
- 233-MHz Pentium MMX
- 3.2GB hard disk
- About \$2,000 in Japan

Fujitsu claims that the final, magnesium alloy-encased version of the machine will weigh in at 2.65 pounds, but the unfinished model sent to PC Magazine Labs was closer to 3 pounds. Despite their small chassis, both machines integrate lithium ion batteries likely to provide 2 to 4 hours of life.

Display quality: Though the image quality of both displays is remarkably good—especially considering the sizes of these machines—the LifeBook, because of its greater depth, affords the larger screen. Whereas the VAIO PCG-C1 display measures 8.2 by 3.8 inches and 1,024 by 480 pixels, the LifeBook's is shaped like a traditional notebook display, offering 800-by-600 resolution from a 6.8- by 5.1-inch frame.

Pointing devices and keyboards: Unlike the displays used by most Windows 98 machines on the market, the LifeBook's display is touch-sensitive, letting you navigate Windows with an included stylus pen if not your bare finger. The machine also includes a rather large pointing stick that sits just beneath its keyboard. Situated in the middle of the keyboard, the VAIO PCG-C1's pointing stick is closer



to the size of a standard IBM TrackPoint. The VAIO PCG-C1 also boasts larger, more supple keys—which, at 17 mm, are only slightly smaller than standard notebook keys—though it lacks the LifeBook's small palm rest.

Power and storage space: We've yet to run our Winstone benchmark program on these machines, but they will likely perform on a par with many low-end notebooks and such ultraportables as the Sharp Actius and the Toshiba Portégé 3010CT. Each also provides over 3GB of hard disk storage.

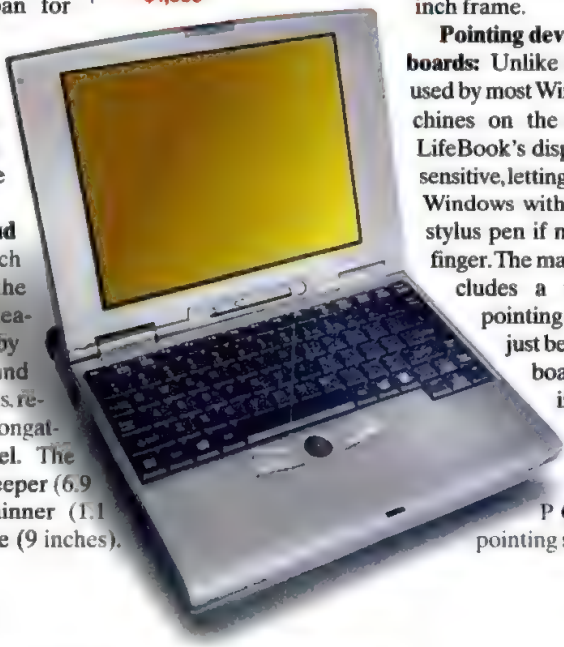
Input/output: Naturally, the standard complement of I/O hardware has been scaled down for these machines, but both are equipped with USB ports, audio jacks, infrared support, PC Card bays, and internal 56-Kbps V.90 modems. The VAIO PCG-C1 even adds a FireWire port, while the LifeBook has a rear PS/2 port. Sony does not offer a docking station for the VAIO PCG-C1, however, forcing owners to buy three separate external devices if they need VGA, serial, and parallel ports. To its credit, Fujitsu supplies a lightweight bar that attaches to the rear of the LifeBook, providing all major ports. Both machines also ship with external floppy disk drives and can be used with external CD-ROM drives.

Extras: Whereas the LifeBook is a very small PC with a touch screen, the VAIO PCG-C1 is a unique multimedia device. Its "Motion Eye" camera sits on a swiveling hinge above its display, letting you photograph objects in front of and behind the system. Sony software lets you take still and moving pictures without any training. Such capability alone will be reason enough to purchase the VAIO PCG-C1 when it arrives sometime later this year.—Cade Metz

FUJITSU LIFEBOOK B112

www.fujitsu-pc.com

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366-MHz PII Portables

Intel brings a new Mobile Pentium II CPU to market with faster clock speeds and an improved L2 cache design. PC Labs tests eight systems.

By Carol Venezia

Are you among the legions of road warriors who constantly crave more processing power for your portable? Well, there's good news from Intel. At the end of January, the company announced yet another addition to its Mobile CPU family—the 366-MHz Pentium II. And it's not just a speed boost this time: Intel has also refined the L2 cache design to deliver even more performance.

This Mobile PII (better known among industry insiders by its code name, *Dixon*) is the first mobile processor from Intel to use integrated L2 cache. Like the Celeron, the Dixon processor has full-speed, on-die Level 2 cache—in this case, 256K worth (Celeron, by comparison, has 128K of integrated L2). Previous-generation Mobile Pentium II processors used 512K of half-speed, off-die L2 cache.

The new design allows

not only for lower power consumption (which translates to longer battery life), but also for better performance. This is because L2 cache access is three times as fast in on-die configurations as in off-die ones. And although the die is significantly larger (20.6 million transistors versus 7.5 million in previous Mobile Pentium IIs), the total package is smaller, because there's no need for separate L2 cache and TAG RAM chips.

Dixon processors use ball-grid-array packaging, which is a fraction of the height, weight, and footprint of existing Mobile Pentium II CPUs. That's why you'll find these new processors in so many different types of notebooks, from 8-pound, three-spindle machines to 4-pound ultramobile units.

THE PLAYERS, THE PERFORMANCE

For this roundup, we received eight Pentium II/366 notebooks; you'll also find a 333-

MHz version of the Dixon processor available in numerous systems, as well as performance-enhanced ver-

sions of the 266- and 300-MHz Mobile Pentium II. The latter two CPUs (the 266PE and 300PE), like the 333 and 366, will have 256K of integrated L2 cache.

The different types of notebooks that we tested for this roundup show just how diverse your options will be if you decide that you want the fastest Mobile PII that money can buy. We received everything from a new 4-pound machine from Hewlett-Packard—the HP OmniBook 900—to the 10-pound Dell Inspiron 7000 A366LT, which touts a 15-inch display and unparalleled hardware DVD playback.

So how well did the notebooks perform? On our ZD Business Winstone 99 test, we found that these 366-MHz Pentium II notebooks performed about 13 percent better than similarly equipped 300-MHz notebooks. Also, battery life was about half an hour longer.

Another thing we noticed during testing was the differences in DVD playback quality from notebook to notebook. Note that hardware decoding doesn't always mean flawless DVD: Although the hardware-assisted playback was, in general, better than that of software, in

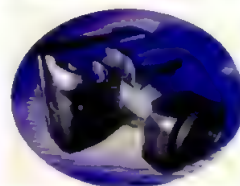
PAPER TRAILS:

We take a look at three newly updated document managers that will keep the information in your digital and paper documents at your fingertips. *Page 56.*



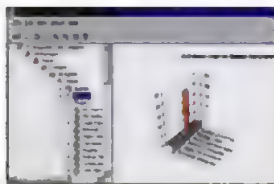
CLOSE UP:

The newest Sony Digital Mavica MVC-FD91 adds a 14X zoom lens to its straight-to-floppy-disk digital camera. *Page 71.*



GUARD YOUR NET:

Tighten your network's defenses with Axent's Enterprise Security Manager 5.0. *Page 76.*



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FIRST LOOKS

some cases it wasn't perfect.

But the bottom line in this story is that if you want the speed and you want to take it with you, the Mobile Pentium II/366 will get you there with battery life to spare. And you'll have a multitude of different system types from which to choose.

Compaq Armada 7400

Commercial business buyers who require a notebook that complies with all the relevant standards and that's backed by a comprehensive management strategy should take a look at the Compaq Armada 7400. With a street price of \$4,400, you will pay more for this notebook than other systems in this roundup (most notably, the Armada's closest competitor here, the Toshiba Tecra 8000). On the plus side, the Armada outlasted the group on our BatteryMark test, posting an impressive 3.5-hour time.

Compaq took a slightly different design approach with this portable. In order to keep its height and weight down, the Armada's keyboard recesses into its magnesium alloy case when the lid is closed. As you open it, you

see and hear the keyboard pop up for use. This feature helps keep the Armada's profile down to 1.6 inches, and its travel weight to just under 8 pounds.

The Compaq Armada 7400 is a two-spindle notebook, featuring a MultiBay up front that supports either a 24X CD-ROM drive, an LS-120 drive, a DVD-ROM drive, or a second hard disk. Our test machine included a CD-ROM drive, a floppy disk drive (which can be used simultaneously via a \$150 external connector), and a 6.4GB Smart hard disk installed in its primary bay. System audio is provided by Compaq's 16-bit PremierSound, augmented by line-out, headphone, and microphone jacks on the right side of the notebook, as well as stereo speakers integrated into the wrist rest. Also on the right is a jack for the unit's integrated 56K V.90 modem.

Open up the Armada and you'll find a 13.3-inch display (14.1-inch panels are also available); graphics are driven by an S3 ViRGE/MX AGP accelerator with 4MB of SGRAM. Below is a full-size keyboard, complemented by four programmable keys on top, which can be set to launch the applica-

tions of your choosing.

The Armada's performance test highlight was its 3 hour 31 minute BatteryMark test score, the best of the roundup. Its other scores were average compared with the competition, although its Disk WinMark

Compaq Armada 7400

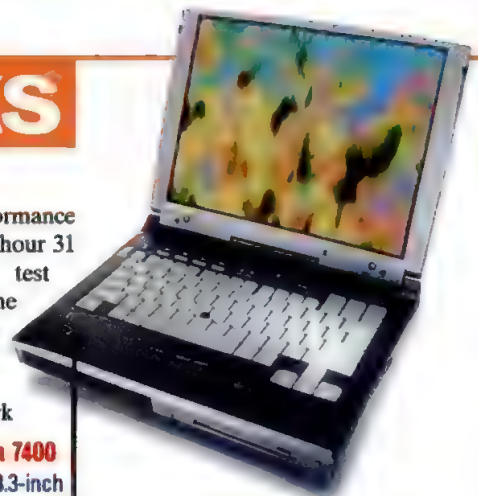
Street price: With 13.3-inch display, 6.4GB hard disk, 24X CD-ROM, integrated 56K modem, \$4,400.

Compaq Computer Corp.,
800-345-1518;
www.compaq.com.

score was second only to IBM's.

The real selling point behind this portable, however, is its manageability and service and support features. The Armada features Compaq's Intelligent Manageability with Insight Management Agents, so you can manage the machine over the network. Should your Armada need to be repaired, Compaq will pick it up, fix it and normally return it within two business days. You can also receive e-mail notification of new drivers, ROM updates, and product information via Compaq's InfoMessenger service.

If manageability and long



battery life are your hot buttons, the Compaq Armada 7400 is a respectable pick.

Dell Inspiron 7000 A366LT



Small businesses and individual users who want the biggest hardware bang for their buck should look no further than one of our

Editors' Choices in this roundup, the Dell Inspiron 7000 A366LT (\$3,549 direct). It may weigh over 10 pounds with the AC adapter, but the Inspiron packs many desktop-level features to justify the weight, including this roundup's biggest display. And the Inspiron's notebook DVD-playback quality far outshone the

SUMMARY OF FEATURES

See www.pcmag.com for interactive views

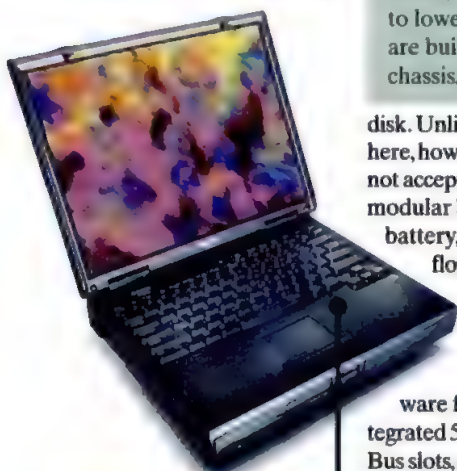
366-MHz Pentium II Notebooks

	Compaq Armada 7400	Dell Inspiron 7000 A366LT	Gateway Solo 5150LS	HP OmniBook 900	IBM ThinkPad 600E	Micron TransPort Trek ²	Toshiba Tecra 8000	WinBook XL ²
Price (with 64MB RAM)	\$4,400 street	\$3,549 direct	\$3,309 direct	\$3,700 street	\$4,500 street	\$3,500 direct	\$4,000 street	\$3,399 direct
LCD panel	13.3 TFT XGA	15.0 TFT XGA	14.1 TFT XGA	12.1 TFT SVGA	13.3 TFT XGA	14.1 TFT XGA	14.1 XGA TFT	14.1 TFT XGA
System/travel weight (pounds)	7.0 / 7.9	9.3 / 10.3	6.7 / 7.6	4.1 / 5.0	5.6 / 6.6	8.1 / 8.9	6.4 / 7.3	7.5 / 8.4
Dimensions (HWD, in inches)	1.6 x 12.5 x 9.6	2.1 x 12.9 x 10.5	1.5 x 12.2 x 9.5	1.3 x 11.5 x 8.8	1.3 x 11.8 x 9.5	1.8 x 12.4 x 10.0	1.7 x 12.2 x 10.0	1.6 x 12.1 x 9.9
Maximum system RAM	256MB	384MB	288MB	160MB	288MB	256MB	256MB	128MB
Pointing device	Pointing stick	Touch pad	Touch pad	Pointing stick and touch pad	Pointing stick	Touch pad	Pointing stick	Pointing stick and touch pad
Number of spindles	2	3	2	1	2	3	2	3
Graphics chip set	S3 ViRGE/MX AGP	ATI Rage LT Pro 2X AGP	NeoMagic MagicMedia 256AV PCI	NeoMagic MagicMedia 256AV AGP	NeoMagic MagicMedia 256AV AGP	Trident Cyber 9397 AGP	NeoMagic MagicMedia 256AV PCI	ATI Rage LT Pro AGP
Memory	4MB SGRAM	8MB SGRAM	2.5MB SGRAM	2.5MB SDRAM	2.5MB SGRAM	4MB SGRAM	2.5MB SGRAM	4MB SGRAM
Hard disk capacity	6.4GB	8GB	6.4GB	6GB	6.4GB	10GB	6.4GB	6GB
CD-ROM or DVD-ROM drive	24X CD-ROM	2X DVD-ROM	2X DVD-ROM	External 24X CD-ROM	2X DVD-ROM	2X DVD-ROM	24X CD-ROM	2X DVD-ROM
56K (V.90) modem	Integrated	Integrated	PC Card	Optional PC Card	Integrated	Integrated	Integrated	Integrated
Standard warranty	3 years	3 years	3 years	1 year	3 years	1 year	3 years	1 year

competition to boot.

There's no denying that the Inspiron is one big notebook: The system outweighs its closest competitor here, the Micron TransPort TREK², by nearly a pound and a half. Most of that extra weight goes to the machine's 15-inch TFT display, the housing for which hangs over the notebook's base by about 0.25 inch.

What you'll also get with this notebook is absolutely flawless DVD performance. The unit's front-mounted DVD-ROM drive (which is actually a combo DVD/floppy disk drive) works in concert with an internal hardware DVD decoder card that supports full-motion video. This subsystem produced no-compromise, stellar images,



Dell Inspiron 7000 A366LT

Direct price: With 15-inch display, 8GB hard disk, 2X DVD-ROM, integrated 56K modem, \$3,549.
Dell Computer Corp.,
800-388-8542;
www.dell.com;
410 at www.pcmag.com/infoclink

with no jaggies, blurriness, or jerkiness, even at full-screen size. There's also an S-Video port on the back of the machine, so you can watch movies on a television (a composite video adapter is also included).

You won't lack for storage space with the Inspiron—the unit features a huge 8GB hard

Editors' Choice

- Corporate: Toshiba Tecra 8000
- Small business/single user: Dell Inspiron 7000 A366LT



Intel's 366-MHz Mobile Pentium II processor delivers the best of

both worlds for road warriors—top performance and long battery life. And whether you're buying for yourself or for a business large or small, you'll find that there's a PII/366 notebook to suit your computing habits.

Our Editors' Choice for corporate users is the Toshiba Tecra 8000 (\$4,000 street). This portable is ideal for companies concerned about costs associated with deploying notebooks, because it was designed from the outset to lower those costs. All Tecra 8000 machines are built using the same motherboard design, chassis, software image, and chip sets, so you

have to qualify the platform only one time. And they feature all the leading-edge components you'd expect, at a significantly lower price than its corporate-focused competition.

For small businesses and individuals, our Editors' Choice is the Dell Inspiron 7000 A366LT (\$3,549 direct). If you don't want to sacrifice anything but still need an affordable notebook, this Dell's the way go. The Inspiron's DVD playback quality was absolutely flawless and far superior to the competition, particularly in full-screen mode. The notebook's graphics subsystem—which includes a 15-inch XGA display and an ATI Rage LT Pro 2X AGP controller with 8MB of SGRAM—plus an integrated hardware-DVD decoder add up to first-rate viewing. Top it off with an 8GB hard disk, an integrated 56K modem, and a three-year warranty, and you've got one great notebook.

disk. Unlike the other machines here, however, the Inspiron cannot accept a second hard disk; its modular bay will take a second battery, a combo CD-ROM/floppy disk drive, or a Zip Drive in place of the DVD/floppy combo drive, however.

Other salient hardware features include an integrated 56K modem, two Card-Bus slots, and 3-D surround PCI

audio. And although the speakers themselves are integrated above the keyboard, sound is ported out the side of the notebook, which protects the speakers in case you dump coffee on your keyboard.

The Inspiron was a top-tier performer on our benchmark tests, helped in part by its graphics subsystem. The notebook uses an ATI Rage LT Pro 2X AGP accelerator with 8MB of SGRAM;

the latter feature was an industry first and has yet to be duplicated. Not surprising, the Inspiron posted the top Graphics WinMark score, and placed third on our Winstone test. And given the size of its display, the Inspiron's BatteryMark score was quite impressive at 2 hours 49 minutes.

Dell also includes 30 days (or 150 hours, whichever comes first) of free Internet access through its ConnectDirect service; unlimit-

BENCHMARK TESTS

366-MHz Pentium II Notebooks



The good news with these new 366-MHz Mobile Pentium II notebooks is that you don't have to sacrifice battery life for fast performance. On the average, these machines performed

about 13 percent better on our ZD Business Winstone 99 tests than 300-MHz Pentium II notebooks we've tested in the past. And as you can see from the numbers, BatteryMark scores ranged from 2.5 to 3.5 hours.

High scores are best.

Bold type denotes first place.

denotes Editors' Choice.

	ZD Business Winstone 99 Score	ZD Business Graphics WinMark 99 Score	ZD Business Disk WinMark 99 Thousands of bytes/second	ZD BatteryMark 2.0 Hours:minutes
Compaq Armada 7400	16.1	94	1,765	3:31
Dell Inspiron 7000 A366LT	17.0	121	1,690	2:49
Gateway Solo 5150LS	16.3	77	1,710	2:51
HP OmniBook 900	17.3	99	1,630	2:30
IBM ThinkPad 600E	17.2	71	1,825	3:00
Micron TransPort Trek ²	15.8	88	1,630	2:30
Toshiba Tecra 8000	16.5	74	1,680	3:10
WinBook XL ²	16.6	118	1,600	2:57

FIRST LOOKS

ed surfing after that is \$21.95 per month. Just because you pay less for an Inspiron doesn't mean that you get less—to the contrary—you get much more.

Gateway Solo 5150LS

Another portable in this roundup that's well-suited for the small-business set is the Gateway Solo 5150LS. The Solo may be the lowest-priced machine in this roundup at just \$3,309 (direct), but you get a lot for the money, including a 120MB SuperDisk drive. This notebook could also find a home in a corporate setting, as it is DMI 2.0 compliant, comes preloaded with Intel's LANdesk Client Manager 3.3, and can share certain components such as docking stations with the Gateway Solo 2500 and 9100 machines.

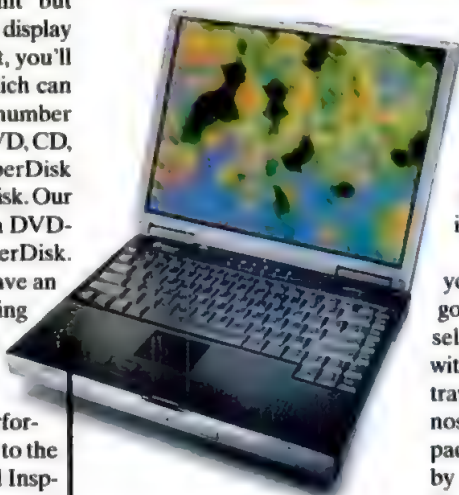
With an AC adapter, the two-spindle Gateway Solo 5150LS weighs in at just over 7.5 pounds and measures just 1.5 inches thick. It's just a bit lighter than Compaq's Armada unit but houses a larger diagonal display at 14.1 inches. Up front, you'll find a modular bay, which can accommodate one of a number of devices, including DVD, CD, floppy disk drive, SuperDisk drive, or a second hard disk. Our test machine included a DVD-ROM drive and a SuperDisk. The machine doesn't have an integrated modem, relying instead on a 56K PC Card (included in above pricing).

The Solo's DVD performance was not quite up to the standard set by the Dell Inspiron. Using a Kingmax ZV-DVD PC Card for MPEG-2 and AC3 decoding, video was

acceptable when played in a window; however, when viewed in full-screen mode, images became fuzzy, colors were uneven, and edges were jagged. Gateway includes Koss headphones with its DVD package, as well as a dongle for the PC Card with S-Video, composite video, audio, and Dolby Digital-out jacks.

Getting online with the Solo is easy: Just click on the Gateway InfoHighway Applications icon and choose the service you want. Choices include *gateway.net* (\$17.95 per month for unlimited access), AT&T WorldNet, and America Online, among others. Once you're online, you'll find navigating your way around the Internet a breeze with the Solo's EZ Pad Plus touch pad. Its left and right mouse buttons are augmented by a center rocker switch, which lets you scroll through long Web pages easily. It can also be used to pan and zoom in certain Office applications.

On our benchmark tests, the



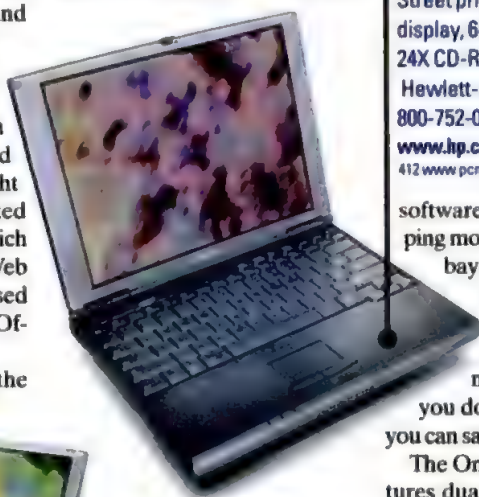
Solo posted average scores on most tests, including a 2 hour 51 minute BatteryMark timing. These scores were due in part to the machine's 6.4GB Toshiba hard disk and its NeoMagic PCI graphics controller with 2.5MB of SGRAM.

Bundled software includes Microsoft's Office 97 Small Business Edition, Bookshelf, and Streets;

and LapLink 2.0. If you want an affordable, feature-rich notebook—and you're willing to sacrifice a bit on full-screen DVD playback quality—consider the Gateway Solo 5150LS.

HP OmniBook 900

A new addition to the OmniBook family of corporate-focused notebooks is the ultraportable 900 Series. The HP OmniBook 900 (\$3,700 street) is very flexible, highly manageable, and integrates well into



the OmniBook family, using the same drive modules, memory, and docking solutions as its big brothers in the OmniBook 4100 line.

If portability is important to you, the HP OmniBook 900 is good choice. The system unit itself weighs just over 4 pounds; with AC adapter, it's the lightest traveler here at 5 pounds on the nose. Its dimensions are compact as well, measuring just 1.3 by 11.5 by 8.8 inches (HWD). This comparatively small footprint does, however, mean that you'll get a smaller screen—in this case, a 12.1-inch, 800-by-600 SVGA panel.

Also because of its size, the OmniBook 900 is a single-spindle machine; our test unit came equipped with a 6GB hard disk. Storage options abound, however, thanks to the included External Module Bay, a sleeve

that connects to the right side of the case. This bay can accept one of the following devices at a time: A floppy disk drive, a 24X CD-ROM drive (both included for the above price), a SuperDisk drive, a 2X DVD-ROM drive, or a second 6GB hard disk.

Corporate customers will be pleased to know that these drive modules can also be used with OmniBook 4100 Series notebooks. Also, HP preloads the

HP OmniBook 900

Street price: With 12.1-inch display, 6GB hard disk, external 24X CD-ROM, \$3,700.

Hewlett-Packard Co.,
800-752-0900;

www.hp.com/omnibook;
412 www.pcmag.com/info/ink.

software necessary for swapping modules in and out of the bay while the notebook is powered on: Just click on an icon on the taskbar, click Remove Device (just as you do with PC Cards), and you can safely swap away.

The OmniBook 900 also features dual pointing devices—a touch pad and a pointing stick—which can be used simultaneously. There are two sets of mouse buttons (one set above the touch pad and one set below), so you can click comfortably whether you choose to use the stick or the pad for mousing around.

On our Business Winstone test, the OmniBook 900 posted the highest score, just edging out the IBM ThinkPad 600E. Keep in mind, however, that the OmniBook's SVGA display was competing in a field of XGA panels; fewer pixels to push around the screen does contribute to a higher Winstone score. On our BatteryMark test, however, the unit tied for last place with the Micron unit, at 2.5 hours.

The company preloads TopTools for Notebooks 4.1 to manage the OmniBook over a corporate LAN as well as McAfee's VirusScan and Crash Monitor.

Gateway Solo 5150LS

Direct price: With 14.1-inch display, 6.4GB hard disk, 2X DVD-ROM, 56K PC Card modem, \$3,309.

Gateway, 800-315-2536;

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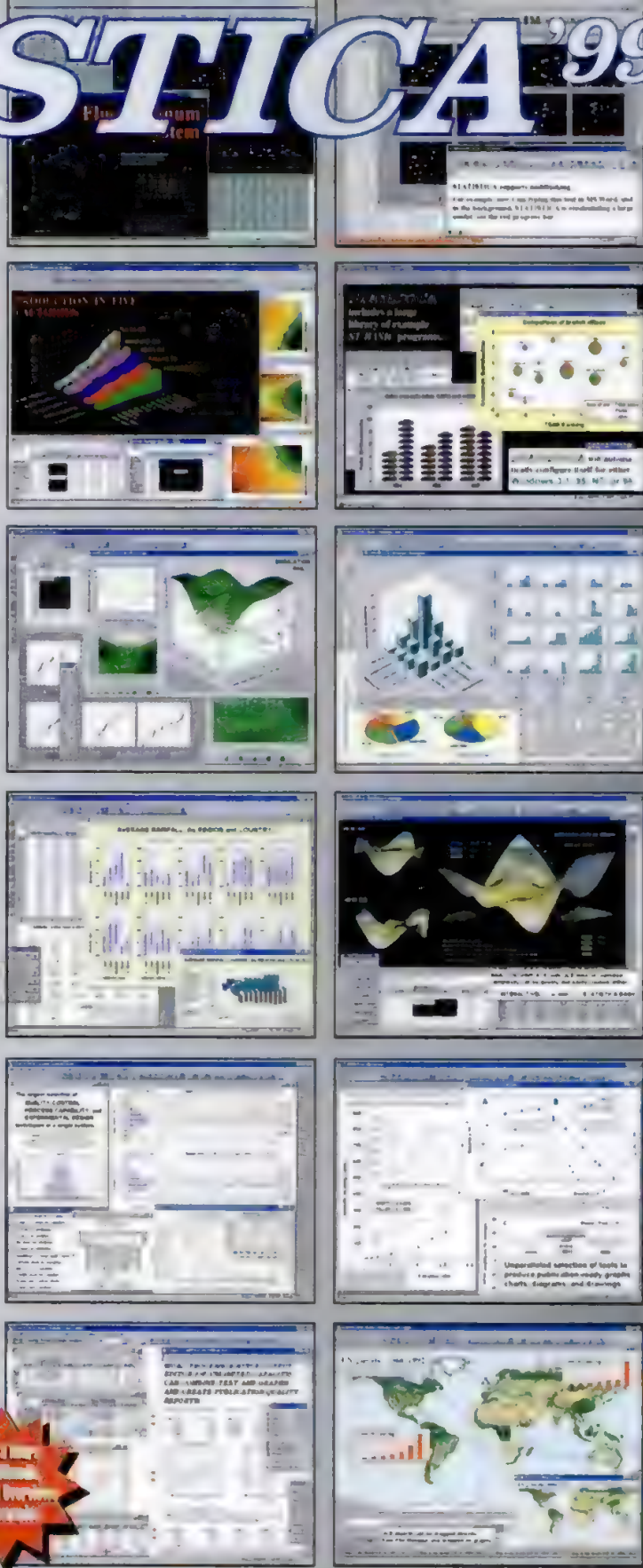
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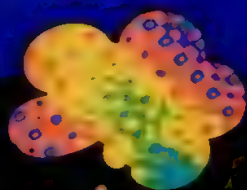
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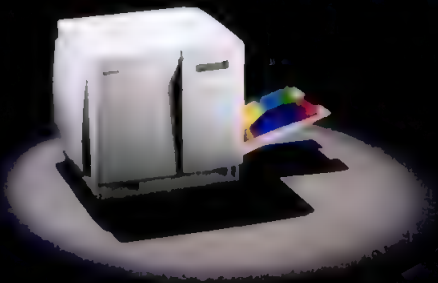
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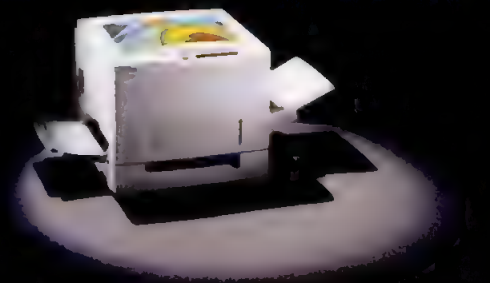
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Choose 001 at www.pcmag.com/info/ink

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Pricing above includes a one-year warranty (a two-year extension is an extra-cost option); the unit does not include a modem, but you can purchase a 56K PC Card modem through HP.

For corporations that need to outfit mobile professionals with a notebook that won't weigh them down and that's easy to manage, the HP OmniBook 900 is a good solution.

IBM ThinkPad 600E

One of the most popular notebooks introduced in 1998 was IBM's ThinkPad 600 Series—and judging by the newest family member, it's easy to see why. The IBM ThinkPad 600E is

IBM ThinkPad 600E

Street price: With 13.3-inch display, 6.4GB hard disk, 2X DVD-ROM, integrated 56K modem, \$4,500.

IBM Personal Systems Group,
800-426-7255, ext. 4751;
www.ibm.com/pc/us/thinkpad;
413 www.pcmag.com/infolink.

one of the lightest two-spindle notebooks on the market (6.6 pounds equipped for travel), but it still gives you 3 hours worth of battery life, a 13.3-inch display, and an integrated 56K modem. On the downside, it's also the most expensive notebook in this roundup, with a street price of \$4,500.

Like other two-spindle portables, the 1.5- by 11.8- by 9.5-inch (HWD) ThinkPad 600E has a modular bay up front, which IBM calls the UltralimBay. It can house either a DVD drive, a 24X CD-ROM drive, a SuperDisk drive, a second hard disk, a second battery, a floppy disk, or a travel cover for maximum portability. Our test machine included the DVD-ROM and floppy disk drives; the latter can be used externally via an adapter sleeve and dedicated connector.

For DVD decode, the ThinkPad 600E uses a software solu-

tion, Mediomatics' DVDEExpress. But although the system's 13.3-inch display supports true-color XGA resolutions, the Mediomatics player ratchets the color depth

and resolution down to 8-bit, SVGA. When it worked right, this setup produced the best windowed playback.

In full-screen mode, though, playback was jerky and blurry, with jagged edges. And selecting options such as fast forward sometimes caused the system to lock up; a hard reset was required to get it running again. IBM does have an optional Marge DVD-to-Go PC Card (a ThinkPad Proven solution for the 600E). Because decode is handled in hardware with this card, full-screen playback should improve.

The ThinkPad 600E was a stellar performer on our benchmark tests, posting the number-two Business Winstone score of the roundup. Aided by its 6.4GB Smart hard disk, the system garnered the top Business Disk WinMark score of the bunch. Its BatteryMark score was also impressive, at 3 hours.

Corporate customers will be pleased by the ThinkPad 600E's manageability features. The unit is DMI 2.0- and WfM-compliant, and it employs IBM's Universal Management Agent, which allows system administrators to manage the machine on the network, regardless of whose software they're using for LAN

management. IBM's LAN Client Control Manager, for remote setup and maintenance, and the company's Asset ID wireless RF technology, for asset deployment and management, complete the package.

For those willing to

this roundup's largest—as well as a 14.1-inch XGA display and an integrated 56K modem.

There's a DVD-ROM drive up front in the unit's modular bay; this bay can also take a sec-

Micron TransPort TREK²

Direct price: With 14.1-inch display, 10GB hard disk, 2X DVD-ROM, integrated 56K modem, \$3,500.

Micron Electronics Inc.,
888-634-8799;
www.micronpc.com;
414 www.pcmag.com/infolink.

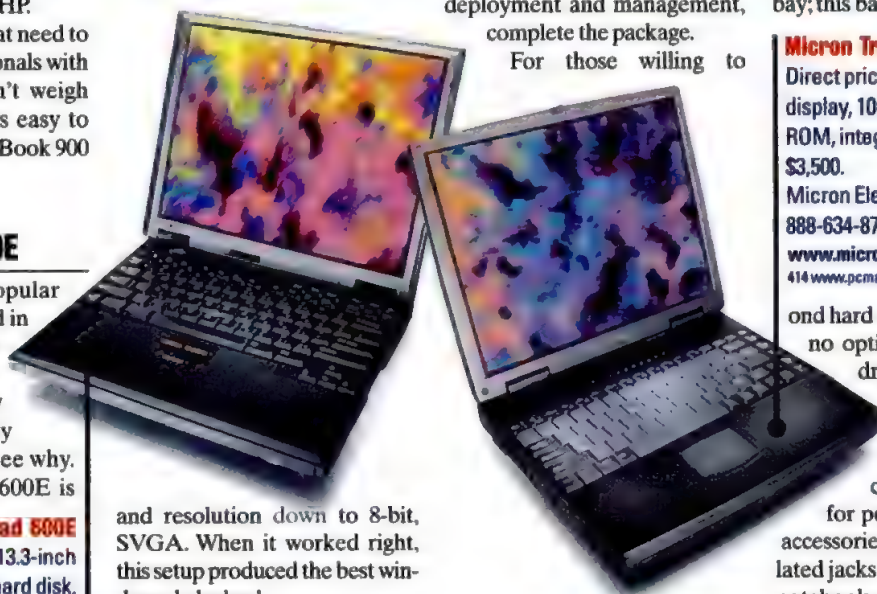
ond hard disk, although there's no option for a SuperDisk drive. DVD decode is handled in hardware by an integrated ALi decoder. You won't want

for ports to attach related accessories, with four audio-related jacks on the left side of the notebook and S-Video in back.

DVD performance was fine in the player's default window size. Image quality suffered slightly in full-screen mode, with jagged edges, a bit of blurriness, and intermittent audio and video skips because of dropped frames. DVD performance was not as good as that of the Dell Inspiron unit, but it's a close second.

Getting online with the TransPort TREK² is easy, thanks to Micron's Easy Internet, a joint venture with AT&T. Click on an icon on the desktop and fill in a few screen's worth of information, and you'll be online in a matter of minutes, no credit card needed. Once you're online, you can take as many free courses as you like for one year at Micron U. There are dozens of online classes, self-paced tutorials, and seminars to choose from; topics cover everything from building a Web site to programming in Visual Basic.

Micron also bundles a fine selection of software with this machine, including Microsoft Office 97 Small Business Edition. The TransPort TREK² is an affordable, all-in-one solution well-suited to its target audience.



pay top dollar, the IBM ThinkPad 600E is a great notebook: Just don't forget the PC Card for the best DVD playback.

Micron TransPort TREK²

Aimed primarily at small and midsize businesses, the Micron TransPort TREK² (\$3,500 direct) is an affordable three-spindle solution. Micron adds value to the machine through a one-year "scholarship" to Micron U (the company's vehicle for providing online computing classes) as well as painless Internet setup through Micron Easy Internet.

In terms of size, the TREK² falls right in between the other two three-spindle notebooks in this roundup. Just shy of 9 pounds equipped for the road and with dimensions of 1.8 by 12.4 by 10 inches (HWD), the TREK² is larger than the WinBook XL² but smaller than the Inspiron.

Inside the box, you'll find all the hardware you'd expect from a notebook of this size, plus a few welcome extras. The system touts a huge 10GB IBM hard disk—



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When using TREK² on the plane, try not to laugh when the 14.1 inch monitor dwarfs the guy's next to you. It's just not a very nice thing to do.

Pack light — there's nothing worse than a carry-on that leaves divots in your shoulder, which is why the TREK² is as thin as 1.7".

Avoid the isolation induced by the single-use, personal mini-soaps of the hotel room by staying connected with an optional 56K modem.*

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Purpose: Online Medical Research
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"Best Buy," April '98

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2

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and those who do not
travel, read only a page.
—William Goins, III



TREK² 266



TREK² 300



TREK² 333



**New!
TREK² 366**

366MHz
Now Featuring
Intel Pentium II processor 366MHz

Model Name	TREK² 266	TREK² 300	TREK² 333	TREK² 366
Processor	Intel® Pentium® II processor 266MHz	Intel Pentium II processor 300MHz	Intel Pentium II processor 333MHz	Intel Pentium II processor 366MHz
Cache	512KB L2 pipeline burst cache	512KB L2 pipeline burst cache	256KB L1 on die cache	256KB L1 on die cache
RAM	32MB EDO DRAM	32MB SDRAM	64MB SDRAM	128MB SDRAM
Hard Drive	3.2GB hard drive (removable)*	4GB hard drive (removable)*	4GB hard drive (removable)*	6GB hard drive (removable)*
Monitor	12.1" SVGA TFT display	13.3" XGA TFT display	14.1" XGA TFT display	14.1" XGA TFT display
Extra Storage	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)
DVD/CD-ROM	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)	24X CD-ROM drive (dedicated bay)
Graphics	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator	4MB AGP graphics accelerator
Sound System	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone	Built-in stereo speakers & microphone
Warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty	5-year/1-year Micron limited warranty
Software Included	Microsoft® Windows® 98 System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™ Norton AntiVirus	Microsoft Windows 98 Microsoft Office Small Business Edition System Wizard Mobile Client™ Norton AntiVirus
Scholarship:	1-year free¹ tuition to Micron U Online	1-year free¹ tuition to Micron U Online	1-year free¹ tuition to Micron U Online	1-year free¹ tuition to Micron U Online
Also Includes:	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports	Zoomed Video capable Li-Ion battery (dedicated bay) Microphone, stereo line-in/out jacks Touchpad pointing device CardBus ready S-Video & NTSC out; MPEG compatible Wavetable/3D Positional Sound 2-way fast infrared port 2 Type II/1 Type III PCMCIA slots 2-USB, parallel, serial, VGA, PS/2 ports
Price	\$1,699 \$59/mo. Business Lease 36 mos.**	\$1,999 \$70/mo. Business Lease 36 mos.**	\$2,499 \$88/mo. Business Lease 36 mos.**	\$2,699 \$94/mo. Business Lease 36 mos.**
Order Code:	20015	20016	20017	20018

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- 56K 3Com USB modem**
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- Microsoft Office 97 Small Business Edition
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Model Name	Millennia HE 350	Millennia 450	Millennia MAX 450	Millennia MAX 450	Millennia MAX 450
Processor	Intel Pentium® II processor 350MHz	Intel Pentium® II processor 450MHz	Intel Pentium® II processor 450MHz	Intel Pentium® II processor 450MHz	Intel Pentium® II processor 450MHz
Cache	32768 Internal L2 cache	32768 Internal L2 cache	32768 Internal L2 cache	32768 Internal L2 cache	32768 Internal L2 cache
RAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	5.4GB Ultra ATA hard drive*	8.4GB Ultra ATA hard drive*	25GB Ultra ATA hard drive*	13.5GB Ultra ATA hard drive*	13.5GB 7200RPM Ultra ATA hard drive*
Monitor	17" Micron 700Hz monitor (15.9" display)	17" Micron 700Hz monitor (15.9" display)	17" Micron 700Hz monitor (15.9" display)	19" Micron 900Hz monitor (18" display)	15" Micron LCD display flat panel
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	48X DVD-ROM drive (two speeds from 4.8X 100-400 drive)	48X DVD-ROM drive (two speeds from 4.8X 100-400 drive)	48X DVD-ROM drive (two speeds from 4.8X 100-400 drive)
Modem	33.6K U.S. Robotics 56K WinModem**	33.6K U.S. Robotics 56K WinModem**	33.6K U.S. Robotics 56K WinModem**	33.6K U.S. Robotics 56K WinModem**	33.6K U.S. Robotics 56K WinModem**
Graphics	ATI Radeon 770 32MB SDRAM 10.25MP graphics	ATI Radeon 770 32MB SDRAM 10.25MP graphics	ATI Radeon 770 32MB SDRAM 10.25MP graphics	ATI Radeon 770 32MB SDRAM 10.25MP graphics	ATI Radeon 770 32MB SDRAM 10.25MP graphics
Sound System	PCI 44-voice WaveTable sound	PCI 44-voice WaveTable sound	PCI 128-voice WaveTable sound	PCI 128-voice WaveTable sound	PCI 128-voice WaveTable sound
Speakers	Advent 8000 stereo speakers	Advent 8000 stereo speakers	Advent 8000 stereo speakers	Advent 8000 stereo speakers	Advent 8000 stereo speakers
Warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty	5-year/3-year Micron Power Limited warranty
Scholarship	1-year free* tuition to Micron U online	1-year free* tuition to Micron U online	1-year free* tuition to Micron U online	1-year free* tuition to Micron U online	1-year free* tuition to Micron U online
Software Included	Microsoft® Windows® 98 Microsoft® Office 97 Microsoft® PowerPoint 98 Norton AntiVirus	Microsoft® Windows 98 Microsoft® Office 97 Microsoft® PowerPoint 98 Norton AntiVirus	Microsoft® Windows 98 Microsoft® Office 97 Small Business Edition Norton AntiVirus	Microsoft® Windows 98 Microsoft® Office 97 Small Business Edition Norton AntiVirus	Microsoft® Windows 98 Microsoft® Office 97 Small Business Edition Norton AntiVirus
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Price	\$1,399 \$49/mo. Business Lease 36 mos.**	\$1,599 \$56/mo. Business Lease 36 mos.**	\$1,999 \$70/mo. Business Lease 36 mos.**	\$2,499 \$87/mo. Business Lease 36 mos.**	\$2,999 \$105/mo. Business Lease 36 mos.**
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Upgrade to:	upgrades to: 4.8X DVD-ROM drive 128MB SDRAM 13.5GB Ultra ATA hard drive Advent 8000 monitor	upgrades to: 4.8X DVD-ROM drive 128MB SDRAM 13.5GB Ultra ATA hard drive Advent 8000 monitor	upgrades to: 48X DVD-ROM drive 128MB SDRAM 13.5GB Ultra ATA hard drive	upgrades to: 48X DVD-ROM drive 128MB SDRAM 13.5GB Ultra ATA hard drive 21" Hitachi monitor (19.4" display)	upgrades to: 48X DVD-ROM drive 128MB SDRAM 13.5GB Ultra ATA hard drive
Price	\$1,757 \$63/mo. Business Lease 36 mos.**	\$1,957 \$70/mo. Business Lease 36 mos.**	\$2,267 \$80/mo. Business Lease 36 mos.**	\$3,549 \$115/mo. Business Lease 36 mos.**	\$3,429 \$120/mo. Business Lease 36 mos.**
Order Code:	50014	50009	40015	50009	40015



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**"MICRON'S NETFRAME 3100 GIVES
YOUR WEB CUSTOMERS WHAT THEY
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SERVER RUNS FULL SPEED AHEAD."**

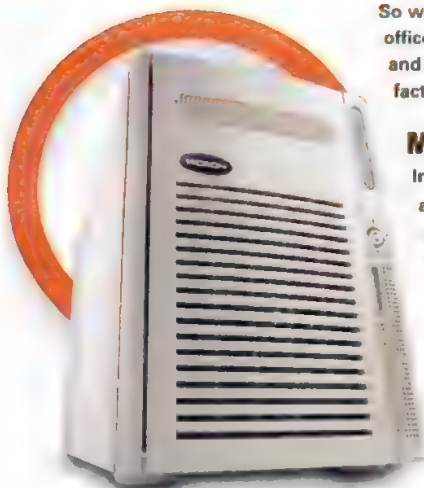
— PC Computing, A-List Editors' Choice



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Micron NetFRAME 6200

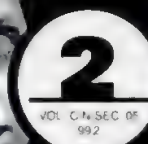
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PLANNED TECHNOLOGY MIGRATION

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Toshiba Tecra 8000



Claiming that your PCs provide lower TCO because they comply with standards is an easy thing to do, which explains why every vendor's doing it. Designing a system that tackles real TCO issues such as cost of qualification is far more difficult, which is why so few companies are doing it. One of these rare vendors is Toshiba, whose Tecra 8000 series of notebooks was developed to solve real problems, not just to fill in checkboxes on a spec sheet. The Toshiba Tecra 8000 (\$4,000 street) is our corporate-focused Editors' Choice in this roundup; it also was a

Toshiba Tecra 8000

Street price: With 14.1-inch display, 6.4GB hard disk, 24X CD-ROM, integrated 56K modem, \$4,000.

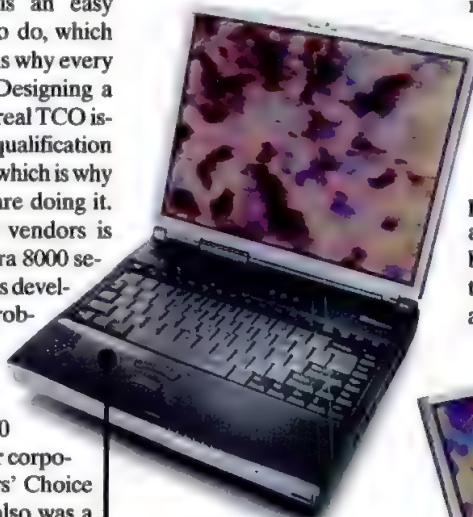
Toshiba America Information Systems Inc., 800-867-4422;
www.toshiba.com;
415 www.pcmag.com/infoink.

winner of our 1998 Award for Technical Excellence.

Corporations looking for a stable, balanced, and highly configurable notebook platform would do well to evaluate the Tecra 8000 series. Regardless of the configuration, each unit in the Tecra 8000 series uses the same motherboard design and the same type of chassis; so moving to new components such as faster processors and bigger hard disks does not mean expensive system requalification. Toshiba also ships the Tecra with its Configuration Builder CD. This product lets administrators create a custom image for their users with just a few mouse clicks.

You'll also find that the Tecra is less expensive than its closest two-spindle, corporate-focused competitors in this roundup, the

Compaq Armada 7400 and the IBM ThinkPad 600E (by \$400 for the former; \$500 for the latter). And you won't lack for hardware: Our test unit came configured with a 14.1-inch dis-



play, a 24X CD-ROM drive, an integrated 56K modem, and a 6.4GB hard disk. With its AC adapter, the Tecra weighs just over 7 pounds; it measures 1.7 by 12.2 by 10 inches (HWD).

There's an option for DVD, which fits into the SelectBay up front (occupied by a CD in our test machine). The SelectBay can also house a second battery, a second hard disk, or a floppy disk drive (included; you can also use it externally via a dedicated port). If you choose DVD, you'll have to give up the internal modem to accommodate a DVD decoder card.

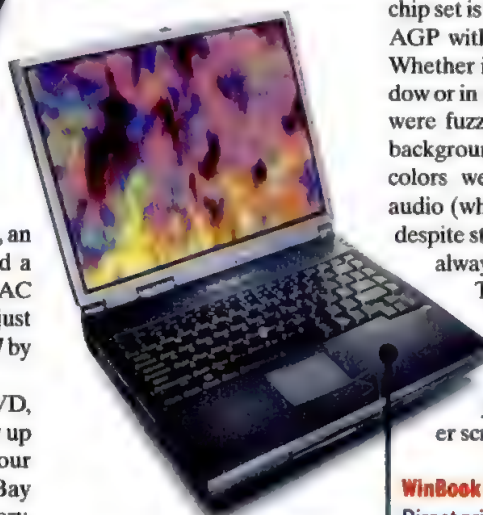
The Tecra performed well on our tests. Its strongest showing was second place on our BatteryMark measure, with a run-down time of 3 hours 10 minutes. It kept pace well with the pack on the Business Winstone test, though the Tecra's Graphics WinMark score was the second lowest in the roundup.

Corporate buyers who want seamless integration rather than endless qualification and maintenance headaches should give the Toshiba Tecra 8000 series their attention.

WinBook XL²

If you need a three-spindle notebook—but you're not willing to lug around 9 to 10 pounds of hardware—the WinBook XL² may be the answer. At just \$3,399 (direct), this machine is also one of the lowest-priced in this roundup; however, low price in this case doesn't come without compromise.

With a system weight of 7.5 pounds (8.4 pounds with an AC adapter) and measuring just 1.6 by 12.1 by 9.9 inches (HWD), the WinBook XL² is the lightest and thinnest three-spindle ma-



chine here. Given these specs, you'll be pleasantly surprised by its core components. Our test machine included a 14.1-inch XGA display, a 6GB hard disk, an integrated 56K modem, a 2X DVD-ROM drive, and an LS120 Super-Disk drive. The WinBook XL² also comes with both a pointing stick and a touch pad, which can be used simultaneously.

so you can't use a Type III card. We were also concerned with the system's build quality. One of the unit's four rubber feet fell off during testing, and the display didn't always spring closed properly, which forced us to move the latch manually to close it (after hearing the disturbing thud of the display latch hitting the notebook's base). Also, the keyboard was overly springy.

Another issue that we had with this machine was with its DVD-movie playback. The WinBook XL² uses an ATI software-based DVD player (its graphics chip set is the ATI Rage LT Pro AGP with 4MB of SGRAM). Whether images were in a window or in full-screen mode, they were fuzzy and shimmery, the background was snowy, and the colors were washed out; the audio (which wasn't very loud, despite stereo speakers) didn't always sync with the video.

The machine does have both composite and S-Video out, however, for projecting images on larger screens, if you so desire.

WinBook XL²

Direct price: With 14.1-inch display, 6GB hard disk, 2X DVD-ROM, integrated 56K modem, \$3,399.

WinBook Corp.,
800-651-4518;
www.winbook.com;
415 www.pcmag.com/infoink.

For corporate customers, the WinBook XL² is DMI 2.0-, PC98-, and WfM-compliant. Also, many of its components—including hard disks—are compatible with WinBook XL and XLi notebooks. Note, however, that WinBook does not have a docking station for this machine, though there's a \$99 port replicator available.

If you're willing to make sacrifices along the way in favor of low cost, the WinBook XL² may be the notebook for you. **PC**

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Microsoft

Where do you want to go today?*

Powerful Web Authoring

Still the industry standard for multimedia authoring tools, Director 7 now focuses on the Net.

By Luisa Simone

The new release of Macromedia Director has been retooled, repackaged, and even retitled for Internet authoring. Macromedia Director 7 Shockwave Internet Studio (\$1,000 street) includes Director 7, Macromedia Fireworks, Sonic Foundry's SoundForge XP, and Shockwave 7.

The logic behind this packaging is impeccable. Fireworks and SoundForge provide a ready source of bitmaps and sound files for Director's multimedia movies. During our testing, we designated Fireworks as the default bitmap editor to gain access to image editing, color reduction, and file optimization tools that far surpass Director's own rudimentary paint functions.

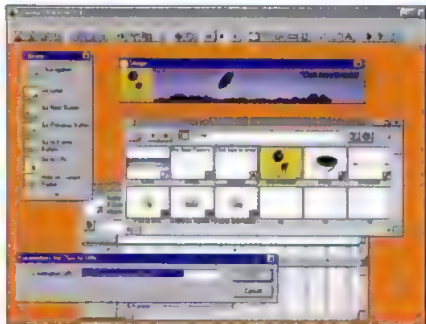
Shockwave is the de facto standard for multimedia playback on the Web. And Version 7 delivers major new benefits to developers and end users. It's smaller and more responsive and now installs seamlessly as an ActiveX system component in Windows.

This lets different browsers (or any applications that can host ActiveX) access Shockwave, so installing duplicate plug-ins is unnecessary. Developers will love the ability to download Xtras (Macromedia's plug-ins) transparently along with movie content. Now they can extend the functionality of a Director movie without grappling with the custom coding or separate installation routines that were previously necessary. And Shockwave 7 is auto-update-savvy, so users always have the most current version.

WEB-CENTRIC FEATURES

Version 7 expands the program's Behavior Library with a host of preprogrammed behaviors that

are turbocharged for Web authoring. Simply dragging and dropping behaviors on objects lets you assign URLs, create rollover buttons, set up interactive chat rooms, and optimize movies to stream over the Internet.



BEHAVE: Director 7's Behavior Library makes it easy to author for the Internet; shown here is the assignment of a URL.

Director 7 now has an entire class of Java-specific behaviors. We were more impressed, however, that Director can now translate Lingo (its internal scripting language) to the equivalent JavaScript code with one simple command at output time.

We serendipitously discovered that Director 7 includes Intel's Web Design Effects. These powerful procedural animations can produce rippling water, waving flags, and sizzling fire in real time from only a few lines of code. The effects are actually much more accessible in Director's interface than they are in the standalone product from Intel (for a review of Web Design Effects, see "Web Animation Creation" in the First Looks section, August, 1998).

OTHER ENHANCEMENTS

Director 7 also includes a number of improvements that are not Internet-specific. Up to 1,000

media elements, drawn from an unlimited group of cast members (single media elements) can be displayed and animated simultaneously. Director also supports faster event processing. For example, you can loop a movie at 999 frames per second to guarantee that you don't miss the click of a user's mouse input.

The visual quality of a Director 7 movie is better than ever, thanks to new import filters, support of alpha-channel transparency, and Shocked fonts. Director 7 can now import QuickTime 3, animated GIFs, and Macromedia Flash movies. These objects are treated as cast members that can be animated via the *score* (which orchestrates cast members' relationships to one another).

Director 7 can also import rich text documents and HTML text. Though the program parses HTML with enough intelligence to maintain links and formatting, it can't preserve the page layout, tables, or frames.

Taking advantage of alpha-channel transparency requires you to create and display the movie in a 32-bit environment. But for truly sophisticated effects, the result is worth the overhead. For example, at runtime you can move *sprites* (one or more animated cast members) around the stage

and still have anti-aliased edges blend perfectly with the background.

MAKING IT EVEN EASIER

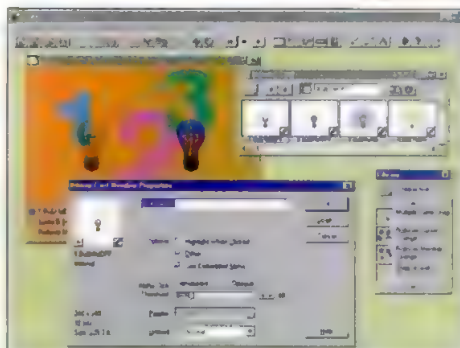
Director 7 addresses the common problem of font substitution, which occurs when files are displayed on a computer that doesn't have the requested fonts installed. A Shocked font is simply embedded into a movie as a cast member. This feature guarantees that the reader always sees high-quality, anti-aliased fonts in the correct typeface. We especially liked the ability to subset a font to reduce file size.

Director 7 also simplifies animation chores by *tweening* (creating in-between frames in a movie) a wider variety of movements, including rotation and skews. Animation effects that required multiple cast-member sprites can now be accomplished with a single cast member. And a new editor lets you create vector shapes directly within the program: You can draw shapes and lines suitable for backgrounds or simple graphic devices.

But be warned: These drawing tools are limited. For example, each cast member consists of a single *geometric primitive* (a simple shape, such as a square) or Bezier line. And there is no way to group multiple vectors together to create complex images.

Director 7 has a clear goal—to produce interactive media that look good and function well on low-bandwidth Internet connections. In a dozen ways, Director 7 meets that goal. **Macromedia Director 7 Shockwave Internet Studio.** Street price: \$1,000; upgrade, \$500. Requires: 100-MHz Pentium processor; 16MB RAM; 64MB hard disk space; Windows 95, 98, or NT 4.0 or later. Macromedia Inc., San Francisco; 800-457-1774; www.macromedia.com; 409 at www.pcmag.com/infolink.

SEE-THROUGH: Director 7's support of alpha-channel transparency lets objects (such as these light bulbs) display variable



Scan, Search, and Serve

Newly upgraded document management programs help you better use and store information.

By David Haskin

Gathering documents is easy these days, but effectively using the information contained within them remains difficult. Three newly upgraded document management programs, however, aim to simplify collecting and

search interfaces, the vendors added utilities for scanning and indexing documents. As a result, both products really are collections of three separate utilities. Recollect Enterprise Courier, on the other hand, handles all the document management tasks in a single interface, importing documents into its internal system of folders and subfolders, which the program calls *drawers* and *folders*.

ISYS:IMAGE 5.0

Although ISYS:Image 5.0 (\$1,295 list) has many virtues, it feels more like a collection of unrelated utilities than a unified document management product. You can launch one ISYS:Image module from the toolbar of another, but none of the modules look or act alike.

You scan documents in the ISYS:Image

fusing. But to give ISYS Utilities its due, the program was easily the fastest indexer in the group, requiring only 3 seconds to index our sample of 30 text files that totaled half a megabyte.

The ISYS Query utility is both powerful and comparatively simple to use for finding specific information. Its new Intelligent Agent feature scans newly indexed documents and looks for items that may be of interest to you. Also, its search dialog box is the easiest to use in the group.

In the search dialog, you create a search by typing a word or phrase, then clicking on a button to add a Boolean operative, such as AND, OR, or NOT. Other buttons add modifiers, such as the proximity of one search term to another.

ISYS Query supports fuzzy searches, which find similar terms such as "jacket" and "racket." It also supports synonym searching (which will, for example, automatically find "car" when you search for "automobile") as well as conflation, which finds different forms of the same word, such as plural.

You can view search results either by filename or by

er. The applet for viewing found documents can display the original TIF image, so you see precisely what it looked like, but its display doesn't show original formatting in existing documents that you add to the index.

Only two of ISYS:Image's modules are simple to use, and the program would benefit greatly from a more consistent interface. But if your emphasis is on simple information retrieval, ISYS:Image has the easiest interface for constructing complex searches.

ISYS:Image 5.0. List price: \$1,295. Requires: 32MB RAM, 8MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. Odyssey Development Inc., Englewood, CO; 800-992-4797; www.isysdev.com; 404 at www.pcmag.com/infolink.

RECOLLECT ENTERPRISE COURIER

Formerly called Recollect Gold, Recollect Enterprise Courier (\$995 list) has the most thorough feature set of these three products and, with its single unified interface for scanning, indexing, and searching, is the most convenient to use.

You click on toolbar buttons to scan paper documents or import documents that already exist on your system. You can import individual documents or entire directories and subdirectories. When you do the latter, Courier adds the original directory structure to its own system of drawers and folders.

managing our ever-growing collections of digital and paper documents and finding precise information contained in them.

ISYS:Image 5.0, Recollect Enterprise Courier, and ZyImage98

are targeted at high-volume document management applications such as litigation support and product development. They work with your scanner to convert paper documents to digital ones and can operate on standalone workstations or in a networked setting.

After you have scanned in your documents, these programs use optical character recognition (OCR) to convert documents to editable text and then index those documents so you can search their contents quickly. The programs also index documents you create with applications such as word processing or spreadsheet programs.

ISYS:Image and ZyImage98 both started out as simple search engines. To their core

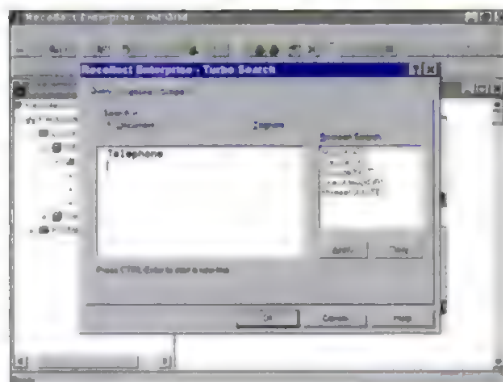
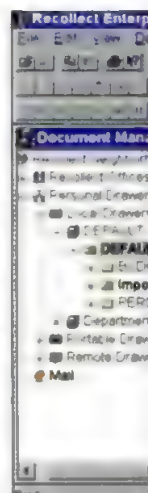
GOOD LOOKING:
The ISYS Query development screen is the easiest to use among the document managers in this group.

module (which is simpler to use than the similar module in ZyImage98), and you click on a button to start the scanning process. The scanned image then appears in a window, and you click on another button to launch the OCR and indexing processes. Or you can scan multiple documents and defer processing until a later time.

The ISYS Utilities application for indexing existing documents was maddening to use. The utility looks like a DOS window, and it can only index entire directories—not specific documents within the directories. Additionally, the dialog box for selecting directories is con-

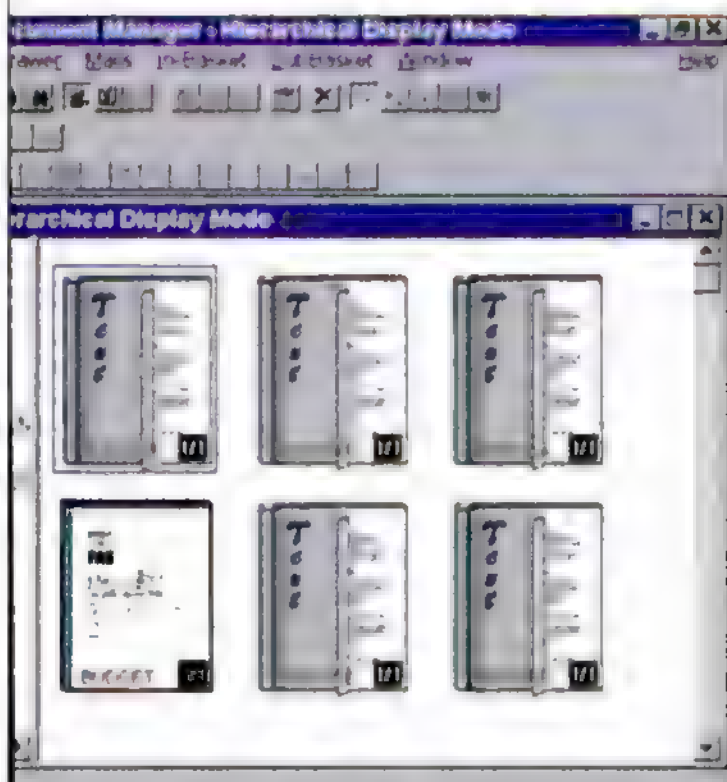
the first few words in the document. ISYS Query ranks documents based on relevancy and supports natural language queries. When you actually view the document, you can create links from one found document to another.

SEARCH ENGINE:
Recollect Enterprise Courier has powerful search capabilities but a somewhat sparse search dialog box.



Whether you scan documents or import them, Courier indexes documents automatically. Indexing speed was the slowest in the group, requiring about 25 seconds to import and index our test group of 30 text documents

FILING SYSTEM: In the main screen of *Recollect Enterprise Courier*, you can create a user-defined system of folders for storing documents, including those on network and removable drives.



totaling about 500K.

Courier's search capabilities roughly equal those of ISYS: image and ZylImage98. It has a unique slider bar for setting the precision of the fuzzy search engine. For instance, you can set the fuzzy search engine to find relatively precise matches of search terms (such as "telephone" and "telephony") or to be more imprecise ("telephone" and "television").

After a search, Courier ranks documents it found according to relevancy and highlights your search terms when you view each document. New in this version is Courier's ability to index specific fields. The field-based information is then stored in a separate database file that you can search as you would a relational database. This enables you, for instance, to index the date and subject fields of memos and then search for all memos about a particular subject within a specific date range. After searching on fields, you can create reports

with the included report generation module (similar to those found in database programs).

Though the program is powerful and generally easy to use, we did find some gotchas. It can't import and index Word for Windows 97 files, a serious shortcoming that, according to the vendor, will be resolved in a release this spring. Another complaint is that the dialog for constructing complex searches is not particularly helpful for beginners. A smaller interface gripe is that you must select your ISIS or Twain scanner from a list. It won't check your system to see which drivers you've already installed.

Other than its inability to manage Word 97 files, *Recollect Enterprise Courier* has relatively minor shortcomings. It is the most complete document manager in this

group, providing brawny document management and retrieval muscle and an all-in-one interface. That, combined with its comparatively low price, makes *Recollect Enterprise Courier* a compelling document management choice.

Recollect Enterprise Courier. List price: \$995. Requires: 8MB RAM, 30MB hard disk space, Microsoft Windows 95, 98, or NT, MindWorks Corp., Sunnyvale, CA; 800-683-8005, 408-730-2100; www.mindworks.com; 405 at www.pcmag.com/infolink.

ZYIMAGE98

ZylImage98 (\$3,595 list) is comprised of three modules: Zy-

Find, *ZyIndex*, and *ZyScan*. Though there's little integration among the modules, *ZylImage98* still provides some powerful and unique capabilities.

You scan documents in the *ZyScan* module, but this isn't as simple as it should be. First, you must create a "job," which means making selections such as picking a directory in which to save scanned images. You can save settings for specific types of jobs, although the wizard for that task is hard to follow.

After scanning, *ZylImage98* won't automatically index the documents; instead, you must switch to the *ZyIndex* module, which applies OCR and indexes the information. You also index existing text documents (such as those you created with your word processor) in this module. You select those documents by dragging them to the module from Windows Explorer. Indexing was fast, requiring just over 6 seconds for our 30-file test group.

True to its roots as a search engine, the *ZyFind* module is quite powerful. It supports fuzzy searching for words that are like the search term and, like Courier, you can

onyms so that, for instance, when you search for "car," *ZyFind* also searches for "auto." But you'd better understand Boolean logic because there is no assistance in creating complex queries other than a help screen.

You can search on text fields such as Date or Subject. You can also save search results and view the list later. The list of results isn't ranked according to relevancy, but it does tell you how many times your search term appears in each document and displays the first few words of the document.

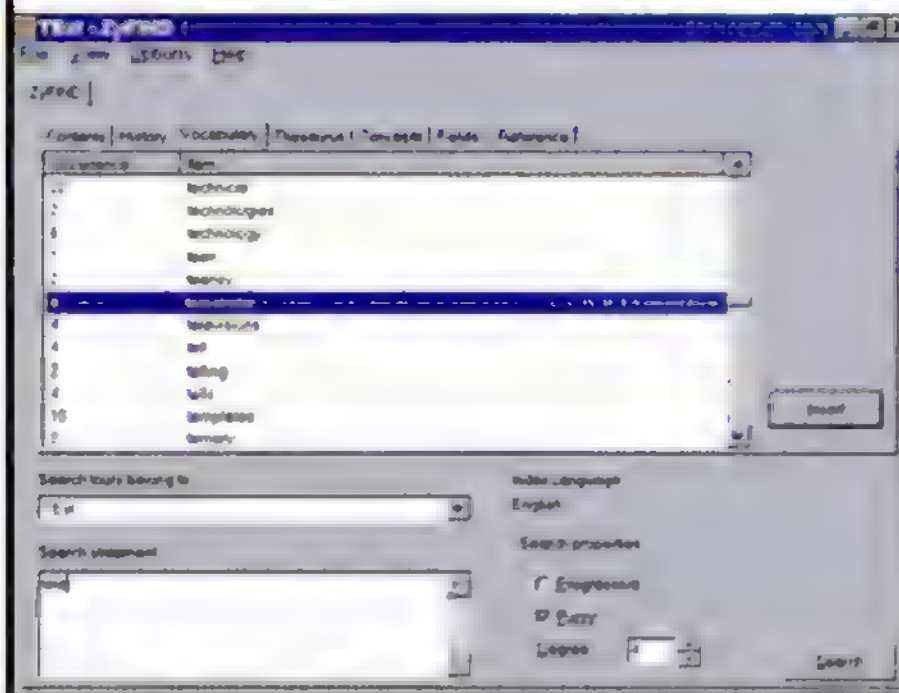
ZyFind now displays the fully formatted image of found documents with search terms highlighted within it, not a plain text version. New features that add value to the product include a publishing tool that copies selected documents to CD-R disks, and Jaz, Zip, and floppy disk drives, along with the index for those files and a run-time version of the search engine. That enables you to use *ZylImage98* to create disks for distribution. And *ZylImage98* can now encrypt the files it indexes.

That extra value is a good thing, since *ZylImage98* is the most expensive document manager in the group, but it's a good choice if you must disseminate information as well as collect it and if you have a lot of documents you need to index and then search quickly.

ZylImage98. List price: \$3,595. Requires: 32MB RAM, 60MB hard disk space, Microsoft

Windows 95 or 98. *ZyLAB International Inc.*, Rockville, MD; 800-544-6339, 301-590-0900; www.zylab.com; 403 at www.pcmag.com/infolink.

HELPLESS: *ZylImage98's ZyFind* module has strong search capabilities but provides virtually no help in constructing complex queries.



fine-tune how precisely this feature operates. You can create Boolean searches that include a search term's proximity to other words, and you can create syn-

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Hot Web Development

ColdFusion 4.0 lowers the barrier for developers, making creation of Web applications a cinch.

By Robert P. Lipschutz

You don't need to be a hard-core developer to be an effective one, with ColdFusion 4.0 (ColdFusion Professional Server or Enterprise Server and ColdFusion Studio). It's a complete development and deployment environment ideally suited for building today's Web-based e-commerce, content management, and business-automation initiatives.

ColdFusion uses ColdFusion Markup Language (CFML), a set of special tags that are typically placed inside HTML pages and interpreted by ColdFusion Server. The tags perform such tasks as database connectivity and conditional logic, but they also handle other needs of the Web developer. For example, the tags integrate with commonly required services such as SMTP e-mail, LDAP directory service, and HTTP and FTP.

ColdFusion is an ideal choice for workgroup, departmental, and extranet applications in which fast deployment times are critical, often with the work done by less-experienced developers. With the new performance enhancements, such as clustering and native database drivers in ColdFusion Enterprise Server, ColdFusion 4.0 might be right for high-use Internet applications as well.

DEVELOPING WEB APPLICATIONS

ColdFusion takes a Web-centric approach to creating applications, by using pages to store presentation, business, and database connectivity logic. Applications consist of a set of pages containing both HTML and CFML tags, with the HTML for presentation and the CFML tags doing the hard work. The applications can be deployed in either version of ColdFusion Server working with your choice of

Web server and database.

A rich user interface can be fully customized to your tastes. You can choose from a full set of menu options, toolbars, and on-line help and documentation for all of the HTML, CFML, and database-related features and issues you'll face.

By using color coding, automatic tag validation, and pop-up tips, ColdFusion Studio helps your productivity and eliminates mistakes. The tool speaks HTML and CFML, and it also interfaces with the databases and file systems that will be part of your application. For example, you can drag and drop a table field name from a database directly into your code, thus eliminating typos.

CFML includes over 60 tags for database connectivity, conditional logic, input and output, and integration with other Internet and file services. Over 200 additional functions handle items such as date and time, mathematical functions, and string manipulations.

For database connectivity, you embed SQL statements in your pages or use CFML shortcuts to relieve you from the rigor of using SQL statements. You can do presentation with standard HTML or CFML alternatives such as CFFORM and CFTABLE, which add functionality to HTML forms and simplify HTML tables, respectively.

GETTING THE BUGS OUT

With ColdFusion, application debugging is flexible, functional, and fun. You can use the powerful new debugger (included) to

step through the tags in your pages, or you can prerun your pages in an HTML browser. The program spits out intelligible, useful English error messages that help you spot and correct syntax problems with your code.

And like any scripting or coding language, there is a lot of syntax to know—including when to use stop tags (for example, `</input>` is not used in HTML), when to use quotations around variables, and when to use a variable versus its value. ColdFusion

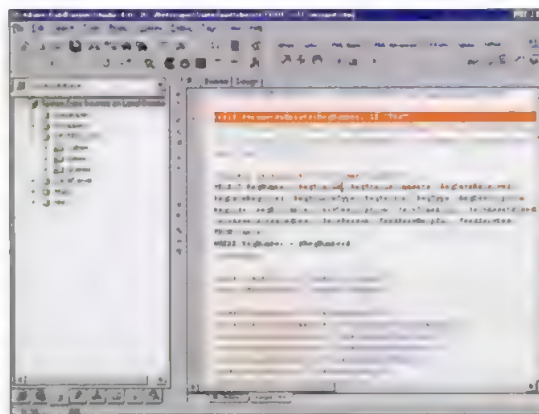
We tested the Enterprise version of ColdFusion using Netscape Enterprise Server 3.5 and the brand-new Microsoft SQL Server 7.0 database using an ODBC driver. ColdFusion Server runs on both the Windows NT and Solaris platforms and has been announced on other platforms, including Linux.

ColdFusion Professional Server (\$1,295 list) will meet the deployment requirements of most applications. You do management through a browser-based interface, and performance monitoring is integrated with the Windows NT performance monitor.

For increased performance, connection pooling is automatically done for database connections, and optional page caching can be done on a page-by-page basis. The `<CFCACHE>` tag instructs the server to cache the result page once it has been processed, to speed subsequent access. For high-use Internet applications, ColdFusion Enterprise Server (\$3,495 list) adds clustering support and native database drivers for Oracle 7.3 and 8.0 and Sybase System 11.

Java-based application servers and Microsoft's Active Server Pages (ASP) get much of the attention in Web development, but ColdFusion 4.0 is a sound multiplatform alternative.

ColdFusion 4.0. List prices: Professional Server, \$1,295; Enterprise Server, \$3,495; Studio, \$395 per seat. Requires: for Professional Server, Microsoft Windows 95 or NT, 50 MB hard disk space, 32MB RAM; for Enterprise Server, Windows NT, 70MB hard disk space, 64MB RAM. Allaire Corp., Cambridge, MA; 888-939-2545; www.allaire.com; 408 at www.pcmag.com/infolink.



COMPLETE:
ColdFusion
Studio is a
complete development
environment.

addresses these potential pitfalls with an interactive tag builder, automatic tag validation, examples of correct tag usage in a snippets directory, and the debugging features.

To use ColdFusion, developers need a combination of HTML and SQL savvy along with some understanding of conditional logic (if/else statements). The development environment includes version control, so teams of developers can work on the same documents.

DEPLOYING APPLICATIONS

A typical Web application deployment consists of a Web server, an application server, and one or more databases. ColdFusion Server is the application server, and it works with any Web server, including Apache, Microsoft IIS, and Netscape Enterprise Server, and most databases through ODBC.



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DO WHAT YOU WANT TO DO.™

Wireless Connections

HomeFree wirelessly networks home PCs to share resources or just play head-to-head games.

By Jeffrey G. Witt

Getting to the heart of home networking desires, the Diamond HomeFree Wireless Combo Pac (\$230 street), from Diamond Multimedia Systems, answers the bell in terms of providing a product that needs no new wires, is easy to install, and is attractively priced. The kit, using wireless radio frequency technology, combines an ISA adapter and PC Card for creating a small network between any Windows 95 or 98 PCs. HomeFree works through most obstructions like walls or doors at a range of up to 150 feet.

HomeFree saves money by providing joint use of peripheral devices. It also lets you play head-to-head games and trade files. These advantages will whet

the appetite of any multi-PC home, but shared Internet access is the main appeal. HomeFree permits simultaneous access from multiple users sharing a single Internet account and phone line.

The adapters are as easy to install as a modem. You're directed through the install via a fold-out poster, and the software setup walks you through one of two paths, depending on whether you have Internet access or need to set up an account. You can select software from several bundled ISPs, including EarthLink, Mindspring, and MSN.

On our tests, WinNat (the software for sharing Internet access) worked seamlessly. We merely fired up the browser on our laptop, and it automatically



UNWIRED HOME:
Connect your home PC with the Diamond HomeFree Wireless Combo Pac.

dialled the modem on our desktop to get to the Web site of our choice. If you're an AOL user, you'll need to start the connection manually, as AOL's proprietary software currently doesn't permit simultaneous connection through the same account.

Keep in mind that in terms of performance, you're effectively sharing the same Internet bandwidth. When we shared our 26-Kbps connection, we weren't surprised to find things somewhat sluggish. Those with faster access will have a greater

comfort zone.

Within the two-machine network, Diamond claims 1-Mbps throughput compared with the 10 Mbps available through traditional Ethernet. But we found that a 5MB file transferred in under 4 minutes, and smaller word processing and spreadsheet files required only seconds to copy.

Similar to cordless phone technology, HomeFree operates in the 2.4-GHz frequency,

meaning there's little chance of interference from other devices in your home. And since the frequency constantly switches between your devices, the network is secure from snooping.

Diamond HomeFree Wireless Combo Pac. Street price: \$230. Diamond Multimedia Systems Inc., Vancouver, WA; www.diamondmm.com; 401 at www.pcmag.com/infolink.

Power Management

Armed with new contact management features, Maximizer Enterprise 5.0 is a powerful sales tool.

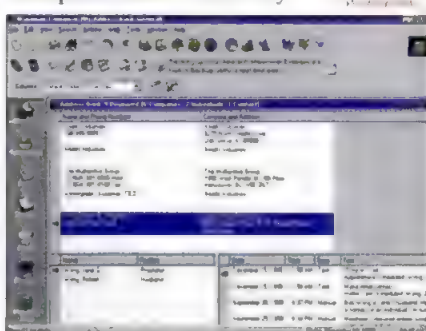
By David Haskin

Maximizer Enterprise 5.0 (\$349 list, per user), from Multiactive Software, is a contact manager of the old school—powerful enough for the most contact-intensive sales forces yet saddled with some hard-to-learn features. This upgrade is slightly easier to use, but it focuses on providing even more workgroup communications and sales automation capabilities.

The new MaxAlarm and MaxFinder are the most noteworthy usability improvements, letting you find contacts and receive appointment alarms even when Maximizer isn't loaded. These features load automatically and display as icons in the Windows system tray.

Maximizer is more communicative, with the ability to save

reports in HTML format, post them to a corporate intranet, and synchronize information with Microsoft Outlook. Also, its module for storing marketing information can now be synchronized throughout an enterprise in the same way



you synchronize contacts and appointments. This enables all members of a far-flung sales organization to access the same information.

Another boon to sales professionals is Maximizer's beefed-up opportunity management module. It now treats opportunities as objects similar to contacts and appointments, so you can attach other objects such as word processing documents to them.

BIG TO-DO:
Maximizer packs a lot of information in its contact.

Also new is the ability to send merged e-mail messages as text. Maximizer still doesn't have its own free-standing e-mail client. Instead, it has a window that displays the contents of the Inbox and other folders of popular clients such as Outlook.

Multiactive also made no changes to Maximizer's hard-to-grasp system of separate yet linked records for companies, individuals, and contacts. Adding to the confusion is the fact that the ad-

dress book window has three panes, which can display seemingly limitless combinations of contacts, companies, and individuals and contact histories for each type of record. Mastering the differences between these records and understanding all the combinations of information you can view on-screen is a significant barrier to learning.

But typical of old-school contact managers, once you overcome this barrier, the address book feature is one of Maximizer's strengths. It creates a lot of flexibility for managing not just individual contacts and colleagues but also all the intricacies related to large, complex accounts.

Maximizer Enterprise 5.0. List price: \$349 per user. Requires: 8MB RAM, 50MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. Multiactive Software Inc., Vancouver, BC; 604-601-8000, 800-804-6299; www.max-enterprise.com; 402 at www.pcmag.com/infolink.



Nokia 446Xs



OUR ENGINEERS WERE GOING FOR A LINE-OF-SIGHT 35° BELOW EYE LEVEL.



OUR DESIGNERS WERE GOING FOR *swoopy*.

Despite their differences, vocabulary being the most obvious, the engineers and designers at Nokia are all focused on the same thing. Namely, to build the world's best monitors.

It's this unique collaboration that makes every Nokia a marvel of technology and ergonomics, as well as contemporary Finnish design.

The Nokia 446Xs is a perfect example. This sleek 19" monitor (17.8" VIS) delivers up to 1600 x 1200 resolution, up to 90Hz refresh rate at 1280 x 1024, with a .22mm horizontal dot pitch. It's a short neck CRT for a smaller footprint, but it saves considerably more than desk space.

Research shows that traditional viewing angles require your eyelids to be more open, allowing moisture to evaporate, causing dry eye and fatigue. We corrected this problem by designing the Nokia 446Xs with a lower base, allowing for an optimum viewing angle of 35° (similar to the angle at which you're reading this magazine). The monitor's lower profile helps users experience less fatigue, not only in their eyes, but also in their neck and back.

It's a monitor of optimum ergonomics. With radically hip overtones, of course. For more details, call 1-800-BY NOKIA, or visit us at www.nokia.com/americas.

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CONNECTING PEOPLE

Big Workgroup Ink Jet

The HP 2500Cxi combines speed, easy connectivity, economics, and drop-dead gorgeous output.

By Bruce Brown

If it were a lot smaller and one quarter the price, the new HP 2500Cxi (\$1,250 street), from Hewlett-Packard, might be the perfect printer. As it stands, the robust ink jet workgroup workhorse should easily meet the printing demands of many network nodes while pleasing IS managers with its low per-page costs and easy setup and maintenance.

The 2500Cxi's text output quality is on a par with monochrome laser printers, and its color photographic printing beats color lasers and competes well with thermal dye and wax printers. In the most telling quality test for this review, we printed a digital camera image rated for 8 by 10 inches at 10 by 15 on glossy media. Image detail remained true, and the colors stayed deep and rich.

The PCL3-enhanced 2500Cxi prints black text at a maximum 600 by 600 dpi, with 304 print head nozzles. Color output, with 304 nozzles each for the separate cyan, magenta, and yellow print heads, uses HP's PhotoREt II color layering with up to 16 drops per dot and a droplet size of 8 picoliters. Automatic printing mode uses ColorSmart II to select the best output settings.

The 2500Cxi comes standard with 4MB of RAM, expandable to 76MB. It's rated to print up to 9 ppm black text in economy or 7 ppm in normal mode. Color print-speed ratings vary depending on mode and media, ranging from 9 to .04 ppm. The printer duty cycle is 12,000 pages a month, up from the HP2000C's 5,000 pages.

The 60-pound, 13.3-by-27-by-29.3-inch (HWD) printer demands a lot of desk space, but that bulk includes four paper-feed paths, including 150- and

250-sheet trays with image-size sensing that really works, a 10-sheet front feed, and a single-sheet rear manual feed. The 2500Cxi can handle media as large as 13 by 19 inches for a maximum of 11- by 17-inch full-bleed printing.

The product's HP JetDirect MIO Internal Print Server-compatible interface made upgrading for network connectivity a snap. Installing an op-

tional 10/100Base-TX HP Jet-Direct Card (\$400 street) involved removing two screws, pushing in the card, and running included software.

With reasonably fast print speeds, great print quality, capacious, flexible, and smart paper handling, and low consumable costs, the HP 2500Cxi should well serve network workgroups that make space for it.

HP 2500Cxi. Street price: \$1,250. Requires: 8MB RAM (16MB for Windows NT), 50MB hard

ADD SOME COLOR

The HP 2500Cxi provides great quality color output for your entire network.



disk space. Microsoft Windows 3.1 or later or NT 4.0 or later. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; www.hp.com; 407 at www.pcmag.com; infolink.

Build a Better Install

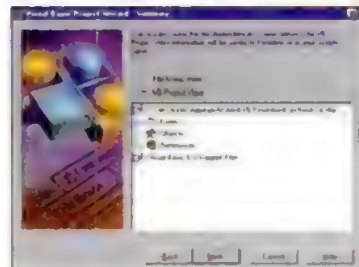
New wizards improve the usability of the renowned installation builder.

By Jay Munro

Here's welcome news for programmers: InstallShield, the professional installation builder, has become more powerful and a little easier to use. InstallShield Professional 5.5 combines InstallShield with InstallFromTheWeb and PackageForTheWeb, as well as Application Repackager.

InstallShield lets a developer control every aspect of a user's installation

SIMPLE: The Visual Basic project wizard walks you through the boilerplate portion of your installation.



with its familiar, Windows Explorer-like integrated development environment (IDE). The project wizard gets you past the tedious work of setting up a basic installation script and walks you through application specification, dialog screen choices, and selection of the file

groups and components to install. It then builds a project framework and puts you into the InstallShield environment.

Using the IDE, you can build a complete installation with little or no code writing. The function wizard helps you choose a function and fill in the parameters. Everything from selecting files to compiling the setup can be done from within the IDE or via wizards.

The introductory manual describes a simple installation that touches on most steps a developer should need. An InstallShield installation is based on the C++-based InstallShield script language, which gives the developer control over the files to be loaded, registry access, version control, and hundreds more parameters.

Visual Basic developers (using Version 5.0 with Service Pack 3.0 or Version 6.0) will appreciate the Enhanced Visual Basic project wizard, which creates installations from Visual Basic project files. A new feature in InstallShield 5.5 Professional is the ability to build a mixed compressed- and un-

compressed-file layout.

The InstallShield debugger lets you step through your scripts much the way a general language debugger does, including watch variables and step-into and step-over functions. Although it takes a little work, you can debug your setup on your target computer—a boon, since most bugs occur when the application gets in the field.

InstallShield Professional 5.5 comes with two other useful applications: PackageForTheWeb and Application Repackager. PackageForTheWeb creates self-extracting EXE or CAB files that are easier to distribute from your Web site. Application Repackager lets you create new installations from old ones. It does a scan of your system before and after running the installation and tracks the changes, letting you create a new InstallShield installation.

InstallShield gives programmers the power and flexibility to build fine installations. Now it's up to them to run with the program.

InstallShield Professional 5.5. List price: \$795. Requires: 32MB RAM, 100MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. InstallShield Software Corp., Schaumburg, IL; 800-374-4353; www.installshield.com; 406 at www.pcmag.com; infolink.

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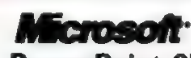
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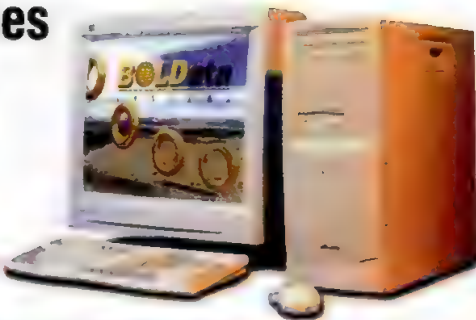
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Mavica Adds 14X Zoom

The Sony Digital Mavica MVC-FD91 upgrades capabilities for still images and video capture.

By Bruce Brown

Our enthusiasm for the Sony Digital Mavica camera series jumps up a notch with the Sony Digital Mavica MVC-FD91 (\$1,000 street). The MVC-FD91 retains the best features of its predecessor, the Editors' Choice-winning MVC-FD81, including a 0.25-inch, 850K progressive scan CCD; XGA (1,024-by-768) image resolution; a 2.5-inch color LCD with bright backlighting; still-image, movie, and audio capture; standard 3.5-inch

floppy disk image storage; and automatic shutter speed from 1/60 to 1/4,000 of a second.

To that impressive package the MVC-FD91 adds a color viewfinder, a 14X zoom lens, pop-up flash, and Sony's Steady-Shot system to compensate for camera shake. If XGA resolution is enough for you, consider the MVC-FD91—it delivers great flexibility.

The 2.1-pound MVC-FD91 is relatively bulky at 4 by 5.1 by 6.5 inches (HWD). The camera runs on rechargeable lithium-ion bat-

teries and includes a battery charger. A full 2- to 3-hour charge will capture up to 650 still images.

Image capture is enhanced with the 180,000-pixel color viewfinder. But the 14X zoom lens with adjustable focus ring is the MVC-FD91's standout feature, giving you the ability to get incredibly close shots. The camera has an aperture range of f/1.8 to f/3.2, with telephoto settings for subjects beyond 2.5 feet and wide angle for subjects as close as half an inch.

You can rotate the LCD 180 degrees to record yourself in still-image or movie mode. Other adjustments include exposure, flash

mode, image quality and size, and white balance. Our test images had sharp color and clear detail



in spite of the camera's sub-megapixel resolution.

The MVC-FD91 stores JPEG still images and MPEG-1 videos on a single disk in its 2X floppy disk drive. With standard image quality, a single disk stores 10 high-resolution (1,024-by-768) uncompressed images and 35 low-resolution (640-by-480) e-mail (compressed) images. The audio capacity is 60 seconds per video at 160-by-112 resolution or 15 seconds at 320-by-240 resolution on a disk.

The unit's microphone records up to 40 seconds of audio per still image and 60 seconds per video clip. Audio can be played back via an internal speaker.

The camera does not connect to printers, monitors, or PCs. But you can view images and videos created with the MVC-FD91 on the camera's LCD screen or by inserting a floppy disk with stored images into a PC (using the bundled MGI PhotoSuite SE) or the Sony FVP-1 Mavica Photo Printer (see the sidebar).

The highly zoomable Digital Mavica MVC-FD91 may not support megapixel resolution, but its image quality is more than suitable for printing, e-mail, and Web site design.

Sony Digital Mavica MVC-FD91. Street price: \$1,000. Requires: 8MB RAM, 38MB hard disk space, Microsoft Windows 3.1, 95, 98, NT 3.51 or later. Sony Electronics Inc., Park Ridge, NJ. 800-222-7669; www.sony.com; 400 at www.pcmag.com/infolink.

Snapshot Printing from Your Mavica

The Sony FVP-1 Mavica Photo Printer (\$500 street) is a companion device to the Sony Digital Mavica cameras, giving you the ability to print images stored on standard 3.5-inch floppy disks. The FVP-1 is a convenient solution if all you want to print is snapshot-size images stored on disk or from a video source.

The FVP-1's dye sublimation transfer printing system produces 24-bit color images with 1.41 million pixels. The ink ribbon print cartridge installs easily, and on our print tests, the FVP-1 consistently produced lifelike color and detail.

The FVP-1 prints on one paper size: 3 7/8 by 5 1/2 inches. A standard paper pack (\$45 street) includes 50 sheets and a print cartridge good for 50 prints. You can feed the paper one sheet at a time or install an optional feeder (\$100 street) to print 25 continuous sheets. In timed printing tests, it took about 2.5 minutes to print a standard image.

The FVP-1 weighs almost 7 pounds and measures 3.25 by 11.75 by 9.5 inches (HWD) without the auto feeder. You can print 1, 2, 4, or 16 split images on a single sheet, floppy disk labels, or index prints of all images stored on a disk.

You can connect the printer to a television or run bundled software on a PC to select images for printing. You can also print images from video cameras connected by standard or S-video cables (neither is included). There is no way to connect the printer directly to a PC.

The bundled printer utility can be used to view and edit images before printing, transfer JPEG, GIF, BMP, and PMP files to a floppy disk, or select from templates for creative designs for standard and split-image formats, stickers, postcards, calendars, and labels.

If you use the FVP-1 to capture images from video equipment, you can convert a picture to a still image, print it, enhance it with the printer utility, or store it on your PC.

For this, you need to connect the printer simultaneously to a television and the video equipment.

The FVP-1 complements Sony Digital Mavica cameras and easily prints digital images directly from disks and video sources. Print size is limited, but the quality is excellent.—BB

Sony FVP-1 Mavica Photo Printer. Street price: \$500. Requires: 32MB RAM, 45MB hard disk space, Microsoft Windows 95, 98, or NT 4.0 or later. Sony Electronics Inc., San Jose, CA. 888-222-7669; www.sony.com/image; 400 at www.pcmag.com/infolink.



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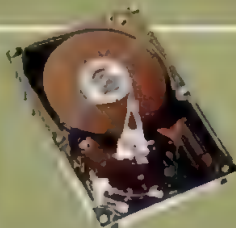
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Back Up With Ease

The latest release of Seagate's Client Exec adds new features to make your backups more efficient.

By Steve Rigney

Most network administrators only back up the data stored on file servers and a few important desktop PCs. This widespread habit leaves the rest of their organizations' data at risk. Fortunately, there are several products now on the market that allow administrators to back up both local and remote client PCs with little effort. The latest of these to pass through PC Magazine Labs is Seagate's Client Exec 2.0 (\$7,600 list for 200 users).

The most appealing feature of Client Exec is its price. Compared with the approximate \$20,000 Connected Online Backup 4.0 and the \$1,695 per 10-user license of CoreData's RemoteWorx 2.1, Client Exec's price tag looks pretty good. Unfortunately though, 200 licenses is the minimum you can buy, which limits the product's potential buyers to fairly large organizations.

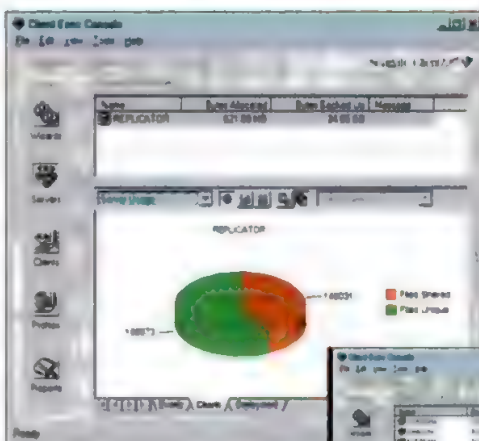
GETTING STARTED

The Client Exec package consists of server software, client agents, and a console application. Based on experience, we recommend that your Windows NT server have at least 128MB of RAM and several gigabytes of RAID-level hard disk space. The client agents will work on Windows 95, 98, and NT, as will the console software. All the components include wizards to help users through installation, which makes the software extremely easy to set up.

The only drawback to the installation routine is the time it takes to install the agents on all of the client PCs. Fortunately, the folks at Seagate have a pretty good solution for this: To in-

stall the backup agents on our client PCs, we were able to use either Microsoft Exchange or Lotus cc:Mail to send the software as an attachment. In the event that you don't have these e-mail servers, you can place the agent software in a shared directory on the server and let the

EASY ON THE EYES:
Client Exec 2.0 offers graphical reports.



client PCs automatically download and install the application.

FACING SPACE

We have found that the biggest challenge in backing up client data is simply having enough disk space on a server. Many client PCs come with 2GB or larger hard disks, and with that much data, it's becoming more difficult for administrators to back up everything to a single server. Client Exec now includes three features—single-instance storage, delta file backup, and network throttling—to back up vital data more efficiently and use less space on your server's hard disk.

The single-instance storage feature lets you keep a single copy of a common file on the server. For example, when we backed up all of our Windows 9x

PCs, Client Exec kept only a single copy of the Windows 9x operating system in the storage database. Only individual information, such as data and registry information, was backed up separately on the server. This feature is also found in competing products, such as Stac's Replica NDM.

Because of the single-instance storage, the time it takes to back up data varies greatly depending on the client PC that you first choose to back up. You should first select a client PC that is a good representative of the applications you are using. We chose a PC that had all of our applications installed as our first backup client. After the initial client information was stored, the other

server over a slow modem link and don't have time or bandwidth to spare.

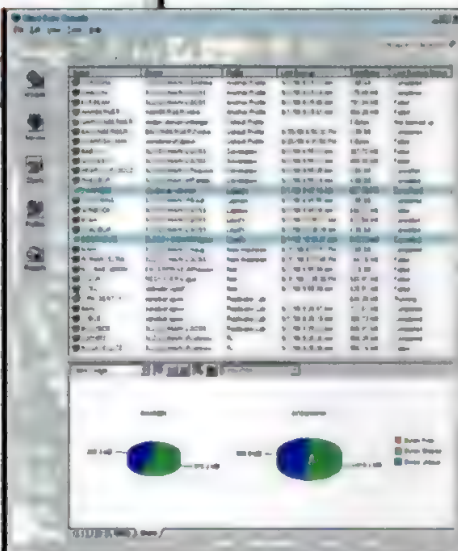
UNIQUE CHOICES

The network throttling feature is one that really sets Client Exec apart. It lets administrators limit the number of users who can back up to the server at one time, limit how much space a user can have on the server, and determine the types of files users can back up.

Client Exec also trumps the competition with its on-demand file restore. After you install the client agents, a new menu called My Backups is created in the clients' Windows Explorer utility. When selected, the file restore utility lets users view all the files stored on the server and select which ones they want to restore. Client Exec also lets you keep multiple versions of the same file on the server. The administrator

can determine the number of versions a user can keep and also whether the user can restore files.

Client Exec includes a thorough reporting utility that lets both the administrator and the client see the status of backup and restore jobs. Users can see when their data were last copied to the server and whether any error occurred. The administrator can use the reporting functions to view backup and restore jobs based



KEEP TABS:
Client Exec 2.0 includes powerful monitoring tools that let you see which files and what users are being backed up.

backups ran much faster.

Client Exec and nearly all of its competitors use delta file backup technology for a reason: It saves backup time and storage space by backing up only changes to data, not entire files. This feature is essential for remote users who connect to the

on users, groups, and files.

Though Client Exec has many similarities with the competition, it's less expensive and requires a lot less work to install and maintain the storage server. **Client Exec 2.0.** List price: \$7,600 for 200 licenses. Seagate Software Inc. (a subsidiary of Seagate Technology Inc.), Scotts Valley, CA; 408-438-6550; www.seagate.com; 900 at www.pcmag.com/infolink.

A Smarter Router

The Netopia RS3100 stands out from the crowd with its easy install and multiple connections.

By Steve Rigney

The Netopia RS3100 series' smart install and connectivity options are the kinds of unique features we are always looking for. We looked at the RS3100-UP model (\$815 list), aimed at small to medium-size businesses. It provides all the ISDN standard router features you need, including a DHCP server, an 8-port Ethernet hub, POTS connections, Network Address Translation (NAT), and Web-based management.

The RS3100-UP model has a street price of around \$570 and includes an unlimited-user license and ports for connecting two analog devices, such as a telephone or fax machine. The 8-port Ethernet hub can work as a standalone device or connect to a larger hub for more users. These

hardware features are not unique to the RS3100, but they are important for most small LANs.

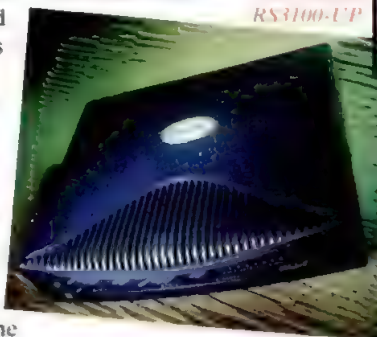
The RS3100 provides status LEDs for every connection port, including ISDN and 10Base-T—even if the port is being managed.

The RS3100 is one of the easiest products on the market to install. The SmartStart wizard walked us through all the necessary steps and, in many cases, automatically discovered our ISDN and network settings. If you happen to be using an ISP that the folks at Netopia know about, the RS3100 will even automatically configure the provider's DNS information. To make installation even easier, ISPs, VARs, and network administrators can preconfigure almost all of the ISDN

and Internet information before shipping the unit to the user.

After we initially configured the router and connected to our ISP, we had several more options for managing the device. You can monitor the RS3100 using a Web browser, telnet utility, terminal, or a SNMP man-

SLEEK AND UNIQUE:
The Netopia RS3100-UP



agement console in addition to a Windows-based utility. We were able to set up 16 user profiles, each complete with its own ISP and authentication information. This, combined with the dial-on-demand feature, lets multiple

users access different ISPs on a first-come, first-served basis. There are even cost control settings that let us define and record when and for how long a user could connect.

To protect you from outside intruders, the RS3100 includes a basic firewall. By default, the unit is configured to deny access to outside users. You can change this setting and still control outside access. For example, we were able to disable NetBIOS access from outside users.

Another standout feature of the RS3100 is its ability to add an analog module for configuring the unit as a dial-up access server. Other upgrade modules include cable modems, xDSL, and even Frame Relay and leased line WAN interfaces. **Netopia RS3100-UP.** List price: \$815. Netopia Inc., Alameda, CA; 510-814-5100; www.netopia.com; 901 at www.pcmag.com/infolink.

Easy Antivirus for LANs

Panda Administrator strives to make distributing and updating antivirus software simpler.

By Les Freed

Installing an antivirus solution on a LAN can be a thankless, endless chore. Although most antivirus software vendors provide frequent signature file updates, it's difficult and time-consuming to distribute antivirus software and updated signature files to all LAN users.

Panda Software's Panda Antivirus (\$49 list per client) is now shipping with Panda Administrator 2.0 and hopes to take some of the load off of the network administrator's back by completely automating the installation and ongoing maintenance of antivirus software on a LAN.

Madrid-based Panda is new to the U.S. market, but the company is the leading antivirus soft-

ware developer in Europe. The company offers 24-hour, 365-day tech support for U.S. customers. Panda also promises to deliver a fix for any new virus within 24 hours of the first report.

Panda Administrator includes both server and client modules that provide antivirus protection for a broad range of client and server PCs, including Windows 95, 98, and NT Server and Work-

station; Novell NetWare 3.x and 4.x servers; OS/2 clients; and Microsoft Exchange Server clients and servers. We tested Panda Administrator on a Windows

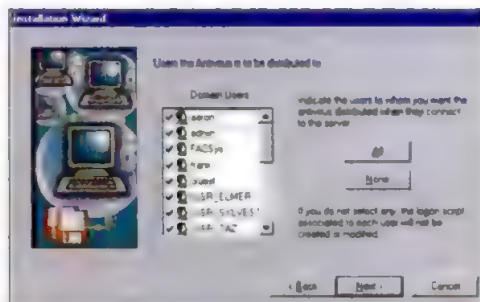
NT Server network with a mix of Windows 95, 98, and NT clients. Panda updates its virus signature database daily, and Panda Administrator can automatically download the latest signature file over the Internet.

Deploying Panda Administrator is a two-part process. First you install the main program on a server. If you're installing the Windows NT version of Panda Administrator, you must install it on the primary domain controller for the LAN. The server installation file copies all of the necessary client modules into a shared directory on the server so that clients can install the software. Once you've completed the server installation,

you must modify your group or individual-user log-on scripts to execute the Panda installation batch file at log-on time. The Panda installer automatically generates a unique batch file for each user on your LAN.

After you install the software and modify the log-on scripts, the server portion of Panda Administrator watches for new users logging on to the server and automatically installs the client antivirus software on those machines. Client users can't defer or interrupt the process, and installation takes 5 to 10 minutes. After the initial installations have been performed, users experience a short delay after each network log-on while Panda Administrator checks to make sure that each PC has the latest version of the software and signature file.

Panda Antivirus with Panda Administrator 2.0. List price: \$49 per client. Panda Software International, San Francisco; 415-392-5850; www.pandasoftware.com; 902 at www.pcmag.com/infolink.



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Network Security Guard

Automate security policy-enforcement tasks with Axent's Enterprise Security Manager 8.0.

By Kevin Young

Among the toughest jobs network administrators face is establishing and enforcing a solid, written security policy. Security detail is difficult, because surveying your network's defenses on a weekly or daily basis is extremely time consuming, particularly in heterogeneous environments. Even simple tasks such as making sure your users are changing their passwords regularly can be burdensome.

A possible answer—particularly for large, mixed-OS networks—is Axent's Enterprise Security Manager 5.0 (\$1,995 list for Manager, \$995 for Server Agents). ESM provides central security management and assessment. It can quantitatively report where your network security holes are and how to fix them.

THREE LEVELS OF ATTACK

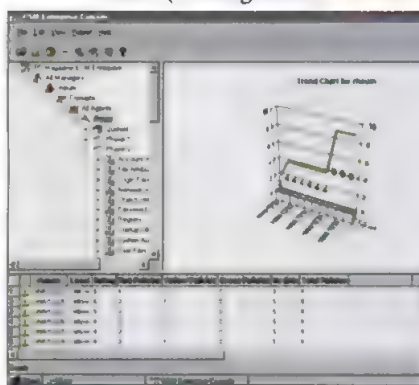
ESM is a three-tier software solution, consisting of a manager, a console, and agents that monitor your servers and workstations to determine whether they meet your list of security criteria. These criteria are chosen by the administrator from over 1,000 security checks, ranging from auditing users' rights to actual password cracking. Depending on your company's desired security policy, you can choose to run a small subset of these checks or you may run nearly all. Axent also provides several default levels of criteria, which you can progressively increase to bring your systems up to security com-

pliance over time.

ESM collects the results into a report, which details whether your machines comply and also lists the severity of potential security breaches. It is then up to the administrator to apply the necessary fixes to bring the machines into compliance.

The manager acts as the centralized collection point for all the agents' data. All data passed on the wire is encrypted using DESX (a strengthened

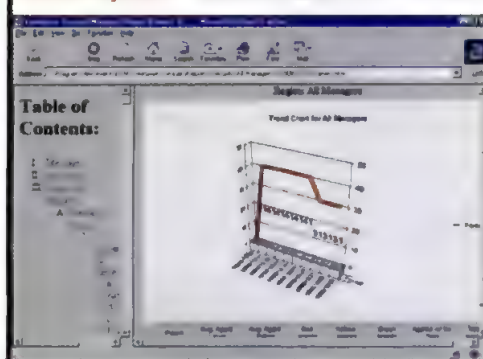
TRACK TRENDS:
You can check the security rating over time.



variant of DES). Axent claims you can manage up to 400 agents on a 120-MHz Pentium or 276-MHz SPARC.

The console can be run remotely or on the manager machine. This component accesses the collected data and presents it in a three-pane view. A Windows Explorer-like tree displays policies, managers, and all machines that have

EASY REPORTING:
ESM can create HTML reports.



agents. This view can get cluttered, but it does have the ability to group machines into security domains. One pane graphs the results of assessments. We didn't find this pane very useful except to display trend data. Another pane is a grid of results, which you can highlight to receive explanations of security problems.

AGENTS BEAR THE LOAD:

The workhorses in this security system are the agents, and they must be distributed to all hosts.

They execute the policies that have been entered into the manager through the console. The advantage of this architecture is that processing power is distributed. Having each machine perform a task individually means you can check all machines

ed ability to delegate authority to less-powerful administrators.)

ESM is not alone in this product space. BindView, ISS, Platinum, and SDI all offer products with similar intents, but they all have slightly different architectures and do not offer as solid a cross-platform strategy. Furthermore, Axent claims to have three times as many checks as any of the others.

ESM also has some competition from network framework vendors such as Computer Associates and Tivoli. These companies provide solutions that not only assess security but can go as far as replacing tools such as Microsoft Windows NT's User Manager for Domains or NWAdmin. These solutions are much more expensive, and once you chose a framework solution, you are pretty much tied to it. (If you have existing solutions, you can plug ESM into Tivoli but not Computer Associates.)

Aside from formal competition, you can always collect your own set of tools such as password crackers and stay on top of OS-patch newsgroups on your own. If you're in a homogeneous operating system environment, this option may be feasible, because tools such as NDS can take care of many of the more

SIMPLE NAVIGATION:
The console has three panes for a clean view.

simultaneously, thereby increasing scalability. The downside is you must deploy the agents to each desktop. ESM attempts to alleviate this burden by offering the ability to auto-discover machines and then remotely install agents.

An excellent added feature is the aptitude to export security reports in HTML, which furthers management's ability to keep tabs on security and can help the less technical find trouble spots. (There is some limit-

trivial security requirements. With a multitude of security checks, a scalable architecture, and strong cross-platform capabilities, ESM is definitely a product to consider.

Enterprise Security Manager 5.0. List price: \$1,995 for Manager, \$995 for each Server Agents, \$95 each for Workstation Agents. Axent Technologies Inc., Rockville, MD; 301-258-5043; www.axent.com; 903 at www.pcmag.com/infolink. **PC**



*Estimated reseller price to end users for IBM PC 300GL model 627735U. Monitor shown is IBM G-64 with 15" screen and 13.7" viewable image, starting at \$239. Certain features described below are available for an additional charge. Actual reseller prices may vary. MHz denotes microprocessor internal clock speed only. Other factors may also affect application performance. PCs in this ad include an operating system. IBM product names are trademarks of International Business Machines Corporation. Microsoft is a registered trademark of Microsoft Corporation. Intel and the Intel Inside logo are registered trademarks and Celeron is a trademark of Intel Corporation. © 1999 IBM Corporation. All rights reserved.

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Opera Dares to Be Different

By Jim Lynch

Much has been written about the browser wars and Microsoft's zeal to dominate the browser market. The context of most of this coverage has been Microsoft versus Netscape, with Netscape generally portrayed as David against Microsoft's Goliath. But Internet Explorer and Netscape Navigator aren't the only games in town when it comes to browsers. There are viable alternatives to both of them.

The most prominent alternative to emerge has been Opera. Opera is a small, lightweight browser from a Norwegian

company. Opera 3.5, the latest version, is a paltry 1.2MB download, far smaller than the download file sizes of IE or Navigator. You can download a free 90-day trial version from Opera Software's site (www.operasoft.com).

Version 3.5 now includes support for CSS1 (Cascading Style Sheets, Level 1), file uploading, Java support, and TLS (Transport Layer Security) 1.0. Opera Software is also offering free e-mail accounts to its users. To have full Java support, you'll need to download Sun's Java plug-in. (You'll find complete installation instructions for Java

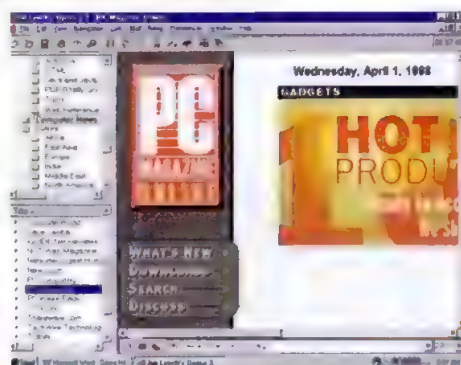
in Opera's help file.)

Opera's interface is highly customizable, and we found that pages loaded significantly quicker in Opera than in either of the two more popular browsers.

Opera can also import your IE and Navigator bookmarks easily, making it a snap to switch completely or to use Opera as a third browser for the times when surfing speed is of the utmost importance.

If you're fed

up with the fallout from the browser wars, be sure to give Opera a test drive. It's a real alternative to IE and Navigator—and well worth the download time.



LIGHTWEIGHT BROWSER: Opera 3.5 is just a 1.2MB download from www.operasoft.com.

REX: Converts and Critics

By Bruce Brown

The 512K REX PRO PC-Card Organizer remains the lightest and least obtrusive way to carry the contacts, task list, calendar, and short notes that you've synchronized from a PC, but it isn't everyone's choice for a personal digital assistant. Readers' mixed feelings about

ly that's true, and you also get more with Windows CE palm-size devices, Psions, and Sharp Zauruses; but all of those are bigger than the REX PRO. The REX PRO, like its predecessor models, is intended only for data reference. The PRO model adds limited data-entry capability—if you call scrolling to select letters

one at a time "data entry." The only reasonable uses of this capacity are deleting entries and making minor corrections. Think of the REX PRO as a note-taker? Forget about it. If you want to use any current REX PRO for more than reference, you'll likely be disappointed.

While testing the original REX PRO, we once accidentally dropped the unit on the floor. When the reviewer stood up to locate it, he realized that he stepped on it as he got up from his chair. The pressure must have been way beyond design spec, but we were delighted to find that the REX PRO had survived. That experience alone made us big fans.

We've found that on occasion the raised, dotlike flush buttons

don't register quickly, requiring a second or third push to get a response. Two readers mentioned problems with the REX PRO's small battery doors; we've found the doors a little tricky to close securely, but once closed, they cease to be a problem.

One reader mentioned problems synchronizing PIM data from Lotus Organizer 5 with the REX PRO. The device can synchronize directly with Starfish TrueSync Desktop; via the included TrueSync Plus (original) an \$80 option for REX-1 and

REX-3 owners), the REX PRO can synchronize with Lotus Organizer 97 or 97 GS (OR3 and OR4 files only); Microsoft Outlook 97 and 98; Microsoft Schedule+ 7.0, 7.0a, and 7.5; Starfish Sidekick 98; and Symantec ACT! 3.0.x and 4.0.

The coming year promises a raft of PDA developments. Although we may see something that tops the REX PRO in its true portability and ability to hold lots of data for quick reference, for now we'll stick with the REX PRO.



MINI-PDA: The REX is tiny, but it performs the same tasks as bulky PDAs.

the REX PRO are no surprise, since the word *personal* in PDA implies that individual styles, preferences, and expectations matter a great deal. We're still convinced that the REX PRO is a winner, at least for those who don't care about adding data to a PDA directly.

Some readers mentioned that the Palm III has a lot more functionality for the money. Certain-

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Tell us what you think... How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below are just a few of the comments from our discussion of the REX PRO.

As a standalone device, the REX PRO is barely functional, despite its ability to add appointments and contacts—slowly. As a computer peripheral, it has a great deal more promise, but I've had a lot of difficulty synching it with software and no luck at all synching it with Lotus Organizer 5.

—William Parnes

A wonderful little tool. Although I loved the utility of the PalmPilot, another item to carry was more than my addled brain could handle. The REX PRO fits easily in my business card case. The new ability to edit on the fly is much appreciated. Sure it's slow, but since my expectations are so much lower, the disappointment is actually less.

—Sam Pettway

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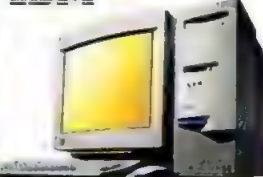
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Teach Your Children Well

Do your kids know how to type? I'm not asking, "Can they eventually find the keys they're looking for?" or "How many fingers do they use?" Can they really touch-type, using all their fingers? Do they have to look at the keys, or can they look at their screens or the documents from which they're working?

Both of my kids learned to touch-type early in middle school. They had a keyboarding class (now called InfoTech) in sixth grade, and another, more computer-oriented course in eighth grade. I assumed that all the kids in our area were getting the same level of instruction at roughly the same point in their educational lives.

Then I started helping my son's Boy Scouts troop with the computer merit badge. They have to be able to answer some basic questions about the history of the computer and the function of various parts and be able to show proficiency with several software packages. Putting up a Web page for the troop was one of this year's goals, so I rolled development of the site into the work on the merit badge. The merit badge guidebook predates the existence of the Web, but what could be more relevant these days than Web publishing? (We're also going to do a multimedia presentation at year's end that summarizes our other activities.)

The boys have been using HoTMetaL PRO 5.0 and a beta version of Microsoft FrontPage 2000 to build their pages (I didn't think they needed to learn the intricacies of HTML except for a few tweaks and fast fixes). The emphasis here is on content and publishing, not programming prowess. Both products have performed admirably, and the kids have made good use of HoTMetaL's calendar creation tool for their upcoming events. I've had to restrain them from festooning the pages with flaming skulls, waving flags, and scrolling banners, all popular with young teens but murder on download times.

They've scanned in pictures of hikes, camping trips, and other activities, and I got a firsthand look at their typing skills as they entered their descriptive text. Only a few of the boys could touch-type, even though all of them were familiar with the keyboard; the rest had developed their own personal styles.

First, we have the Two-Fingered Terrors—kids who pound out the text with their index fingers. They're not fast, they're not particularly accurate, and they can't look anywhere other than the key-

board. You can hear them at work, stabbing the keys hard, with fingers stiff and arms held high over the keyboard. The constant swiveling of their heads from the keyboard to the screen will make a chiropractor happy some day.

Next, we have the I-Know-It's-Here-Somewhere bunch. These typists are noticeably slower than the Two-Fingered Terrors. They obviously don't know the keyboard as well, and they search in time-honored hunt-and-peck style. Interestingly, the IKIHSs use more fingers than the TFTs, but there's little correlation between key location, finger, or even which hand they use. But where is their short-term memory? They seem to search time and again for the same keys that they just used.

Finally, in a class by himself, we have Nintendo Boy. Like the TFTs, Nintendo Boy uses just two fingers, but one of them hovers over the Shift, Ctrl, and Alt keys, while the other dances all over the keyboard in a mad frenzy. The first time I saw him do this, I almost burst out laughing—I thought he was doing a clever parody of the TFTs. No, this is what happens when kids grow up with video games and don't get typing lessons.

These kids need help. I'm going to point them toward some typing-instruction shareware, because they're obviously not getting the instruction they need in school. If these habits become too deeply ingrained, they'll have a tough time unlearning them.

If you know anyone like this (or if you resemble those in these remarks), search for *typing tutor* at www.hotfiles.com. You'll find some good, inexpensive shareware. TypingMaster 98, for instance, offers two simple games and detailed statistics on speed and accuracy, and it comes in at the high end of the range at a mere \$25. Ten Thumbs Typing Tutor also has a couple of games, personalized training sessions, and animated graphics, and the tool costs only \$9.95 to register. You'll find at least 20 more, and one is sure to be right for you.

The keyboard isn't going away any time soon; teach your children well. **PC**



This is what happens when kids grow up with video games and don't get typing lessons. These kids need help.

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The Future of Adobe

One of the most interesting companies in the computer industry is Adobe Systems. Founded by former Xerox PARC researchers, Adobe is going through an identity crisis and suffering from isolationism, which leaves it open to attack from Microsoft. The company's future is not secure.

Microsoft's competitive behavior in various market segments is scrutinized, but not many people have noticed that the company is slowly moving toward one of the few consumer market segments left to conquer: image editing. Alvy Ray Smith (the graphics superstar and the person originally behind Pixar) is the point man in the development of Microsoft PhotoDraw, a serious challenger to the various Adobe PhotoDeluxe packages. I was particularly impressed with PhotoDraw 2000.

Adobe fought back after PhotoDraw 2000, though, with Adobe ImageStyler, the most phenomenal software package I've encountered in years. Though ImageStyler is obviously derived somewhat from Adobe Photoshop, it has streamlined and unique capabilities impossible to imagine in Photoshop. With ImageStyler you can create an amazing JavaScript-based Web page in minutes. Go to my home page at www.dvorak.org to see one that was done in about half an hour. Simply put, it's a killer product!

But have you heard much about ImageStyler? Probably not, and this is Adobe's problem. Its marketing and PR efforts (which are still mired in the Mac world) are mediocre at best. This is partially due, I believe, to the increased isolation of both John Warnock and Charles Geschke. I began to notice this on a visit I made to the company about a year or so ago; the facility had so much security that it looked more like an armed camp than a Silicon Valley campus. It was a stark contrast to open-air places such as Nortel, with its dramatic architecture.

This isolationism at Adobe is present at all levels, including, apparently, e-mail. I used to have an occasional lunch with John and Charles, for example, but recently I was told by a PR woman that this would be impossible without her. No matter what I said (and this went on for a while), she said no. Trying to send e-mail to Warnock concerning this proved fruitless, as he never returned my messages. I suspect he never saw them.

It's not that I expect every executive to return my messages, but I do expect it from people I know per-

sonally. Steve Ballmer still does! The retreat of the top executives makes Warnock look as if he's missing in action, in much the same way that the marketing for ImageStyler is missing in action. The whole company seems like a rudderless ship.

I believe a lot of the isolationism comes from the fact that Charles Geschke was kidnapped by terrorists a few years ago and pretended that it didn't bother him too much. It spooked everybody in the Valley. The isolationism of this twosome developed slowly, but it began at that time. This is in stark contrast to Billionaire Bill, who seems to be everywhere.

I fear for the future of Adobe. The company's product line is a shambles. Acrobat is a complete waste of resources, yet Adobe clings to it. FrameMaker seems to be a product the company bought and then lost interest in. What was the point? PageMaker, another product Adobe bought, is never talked about anymore, as Quark seems to keep its buzz going. Adobe owns the high-end font market, but so what? Its forays into video editing have gone nowhere. Only Photoshop and Illustrator are dominant, and those are also high-end products for professionals.

I forgot all about Adobe Persuasion until I went to Adobe's Web site. Does anyone ever buy this product? Nobody knows about ImageStyler but me. And finally there's PhotoDeluxe, the dominant product. But it's just a matter of time before Microsoft takes over the photo-editing software market. Right now Adobe owns the OEM-bundled segment, as Microsoft takes over the retail segment.

Because pull-through is the name of the game in small-systems software, how long will it be before Microsoft finds a way to poach on Adobe's territory? Knowing the way Microsoft operates, I'd guess it won't be long. I assume all Microsoft really has to do is find out who's in charge of Adobe's OEM sales and make an offer that's impossible to refuse. This seems to be Adobe's talent stronghold.

As I see things, Adobe is running on fumes and needs some serious rethinking of its product and marketing strategies and PR efforts. I wish it luck.



I fear for the future of Adobe. Its product line is a shambles.

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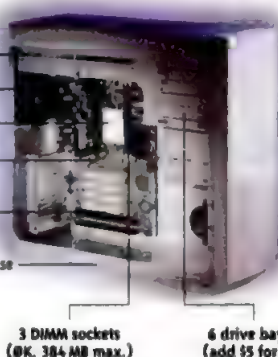
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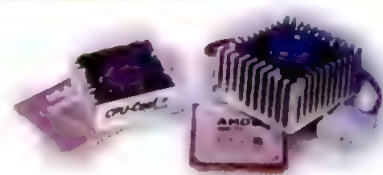
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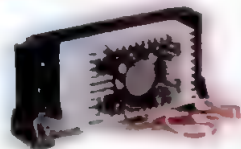
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John C. Dvorak's



INSIDE TRACK

Much of the Linux community has been **wondering** what the heck Linux inventor Linus Torvalds is doing working for Transmeta, a chip company. He's been **saying nothing**, and Transmeta has done a fair job of **promoting itself** by being **extremely secretive**. In fact, the company will be releasing an x86 clone to hit a gaping hole in the market: the demand for **extremely low-power-consumption chips**. This is easily extrapolated from material posted on the Web by many of the employees and principals of the company, including an expert in low-power chip design.

Transmeta has also just filed an x86-related patent, and its marketing guy is Jim Chapman, an **offbeat** marketing genius who headed the efforts at Cyrix before cashing out. These chips should be out sometime in 1999. The base chip will be called **the Neon**, supposedly short for *neo-silicon* but actually named to mock the **Intel Xeon** line.

The background of the players in this company seems to indicate that this x86 chip will actually use a **RISC architecture** and will depend on microcode to operate—hence Linus Torvalds and the people he is recruiting. These folks will be writing processor-level code to make the chip **look like an x86**. In fact, the company was **originally rumored** to be working on a PowerPC chip, but it switched without a hiccup.

I suspect that the Neon is a generic processor engine (*neo* means *new*, as in new idea), which can be chameleon-like as a processor (just as neon changes from one thing, a gas, to another, a source of illumination), **mimicking anything**. Interesting idea, if it works. During the early days of RISC there was talk of such a notion, but nobody was able to get past the talk.

Theoretically, if someone could make a generic RISC processor that could load various microcode subsystems, the chip could actually **emulate more than one chip** at competitive hardware speeds. I suspect that nobody has bothered to do this in the past because all the money was to be made doing an x86 clone, period. **Why bother** adding versatility?

The advantages of versatility historically were nil. But with Intel making noise about adding new Katmai instructions as well as changing the basic architecture with Merced, one can see the advantages of a **reprogrammable architecture**. Especially if it were possible to reprogram a chip in the field **after shipment**! Now I don't know whether this is actually what these people are going to announce, but I like the concept. And in fact, there is some of this kind of thinking in the AMD K6/K7 designs, although it is not taken to an extreme.

The weird thing about Transmeta and the slew of other chip makers releasing excellent x86 parts is that two or three years ago, nobody would have believed there would be this much activity in

this piece of the market. Moreover, it makes you wonder **why the OS arena** (the other monopolized segment) gets so little attention except from people promoting free Unix clones.

Other Kinds of Chips Dept.: A lot of people are wondering why IBM has decided to become heavily involved in the CCD chip-making business. **The company must know something** about the booming market for digital cameras (now referred to as *DSCs*, or *digital still cameras*, although Olympus will continue to push the *filmless camera* moniker). IBM will be offering a 1/2-inch 1.3 million-pixel CCD and a 2/3-inch **2 million-pixel** CCD, which looks to be **the next jump** for all the camera makers.

*The base chip will
be called the Neon,
supposedly short
for neo-silicon but
actually named
to mock the
Intel Xeon line.*

Remembering that 35-mm film is about 1.3 inches, one has to suspect that CCDs this large will eventually evolve at the mass-market level, reintroducing all those fabulous 35-mm lenses to the market. I suspect this will take about **five more years** and will coincide with the availability of cheaper memory and the monstrous hard disks needed to capture huge picture files, which will eventually approach 100MB and someday get even bigger. (Everything is relative. Processors that are **1,000 times faster** processing files that are **1,000 times bigger** make for prettier pictures, but how pretty can they get?)

Camera makers are **still freaked** by the incredible success of the Sony Mavica. Now that the Mavica has the ability to capture some fair MPEG video clips, everyone is **worried sick**. Expect to see the real thrust of the Sony HiFD 200MB 3 1/2-inch floppy disk

drive to be **exploited** in an upcoming generation of the Mavica. That development will **seriously spook** Kodak and Olympus.

The appeal of the Mavica is that everyone already has 1.44MB 3 1/2-inch floppy disk drives. And they can pop these disks into their machines. Nobody has the new drive. But because of the **backward compatibility** of the HiFD, the proposed camera will be able to use both standard and HiFD disks and will encourage people to upgrade their desktops to the HiFD drive. Good marketing.

Genuinely Interesting Hardware/Software Dept.: On the surface, the Digital Persona U.are.U biometric fingerprint ID system (www.digitalpersona.com) looks like a gimmick. But in fact, it is one of the **coolest little products** I've seen in years. The U.are.U is so cool that my son ran off with it and uses it routinely to log on to various online accounts. This thing works as a password intervention device. With some add-in software, it lets you **use your fingerprint to log on** to an account. The fingerprint is used as a password that can be replicated by the device. The U.are.U appears to be **fool-proof**; nothing I could do would defeat it. The product costs from \$149 to \$199, depending on the configuration. **Numerous security applications are possible.** I was impressed. **PC**

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Post-PC? Look Around You

At the table to my right, two middle-aged guys (middle managers, probably) were talking about using the Web to check their companies' last-minute price changes on a long list of products. One said he'd gotten in the habit of checking every couple of days. "Me, too," the other said. "You know, I really don't get

this Web stuff, but I'm figuring it out. I'm on there every day. Better than e-mail, huh?" Meanwhile his friend was looking at what I think was a spreadsheet (try as I might, I couldn't see what was on his screen) and copying notes to a pad.

To my left, three professional women, in their thirties maybe, were poring over their appointment books—one was using a PalmPilot—and carrying on an amazingly sophisticated discussion about the advantages and disadvantages of using America Online for Web access and about how they thought AOL's acquisition of Netscape would shake out.

One of them was still an AOL customer; the other two had been but had bailed. One now uses a local dial-up ISP; the other is part of a market test for Time Warner's cable Web access service, RoadRunner. The two who had left AOL were dissecting in great and intelligent detail why they had left: One had had a lot of problems with dropped connections, and the other had thought AOL was awfully slow, especially after she'd seen cable modem speeds.

Then a friend joined them. She had left AOL too and, by the way, had just signed her mother up for a WebTV account to go with the WebTV set-top unit she'd bought her for Christmas.

I was sitting at the little neighborhood café where I begin many mornings. I don't usually eavesdrop quite so overtly as I was that morning last week, but I was fascinated with this swirl of tech talk.

Yes, I live in a tech-savvy community, and yes, I live in a part of town with a great number of people who work in the PC hardware, software, and Web businesses. But none of these people were techies; none worked in the business; none were those legendary "young people" with multiple piercings and Attitude to spare who are generally tagged as the technically literate. Yet they were all comfortably immersed in the use of PCs and online communications. Technology had ceased to be gee-whizzy for them, let alone intimidating. Computer technology was part of their lives.

I consider the assimilation of technology into our

daily lives one of the great and profound changes of the past decade. And it's an achievement all of us should be proud of—*PC Magazine* readers very much included, because you led this revolution.

I also thought back, sitting there over breakfast and eavesdropping like crazy, to a conversation I had a few years ago with my colleagues Bill Machrone and Frank J. Derfler, Jr. We were waiting in the wings during a rehearsal of *PC Magazine's* annual Technical Excellence Awards show at Comdex in Las Vegas. It was probably 1993, maybe 1994.

Bill and Frank were kidding me, asking whether I planned to say to the audience once again that night, "What a great time it is to be in the business"—something both had heard me say to audiences many times since the mid-eighties.

Maybe I should, I said. But for very different reasons than before. Because, I told Bill and Frank, of our new-found *materiality*.

For years, since the PC revolution began in the early eighties, we were at the fringes of business. Sure, it was fun to sneak in all those PCs, to put in the first networks (ugly as they were; remember LAN Manager?), to encourage people to use those funny laptop things.

It was fun, but when we told ourselves the truth, it was peripheral. People didn't run their businesses on PCs and servers; take away people's PCs and they'd complain, but the sun would still come up in the east the next morning.

But now, I said, all of a sudden *we counted*. We and our work were *material to the success of business*. The game had changed, and we had moved from the concession booths to the center ring. And that was very satisfying.

As I recalled that chat with Bill and Frank a few years ago and listened to the table talk around me, I was struck by the convergence of the two ideas. On one hand, we—you and we here at *PC Magazine*, working together—have turned these funny-looking boxes into critical business tools, part of the central nervous system of virtually every company in the



If "post-PC" is supposed to mean "no PCs," then excuse me, but that's hogwash.

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world. On the other hand—and this was a far tougher and deeper challenge, with an even more far-reaching result—we made these sophisticated tools natural extensions of normal people's lives. You don't have to be a PC guru anymore to use and feel comfortable with a personal computer. They're just...you know, *computers*. No big deal.

PC Magazine editor-in-chief Michael J. Miller describes the evolution of this market toward what he calls the Fifth Age of Computing, or "ubiquitous computing." In the Fifth Age, we'll feel comfortable using a great variety of devices, in many cases without even thinking of them as computers. These devices will be connected in many ways, and they'll be woven inextricably into the pattern of our working and personal lives.

That would never have been possible if we had not first gone through this almost-20-year process of familiarization, normalization, and integration of PCs into our daily routines. We laid the groundwork for this future without realizing it: We thought what we were doing *then* was the future. Little did we know.

Many seers talk today about the "post-PC" world. They see it as an era in which the bad old PC—big, ugly, expensive, complicated, intimidating, capable of doing altogether too many things—will be passé; a time when our pockets will be full of information appliances.

Yes and no. Sorry, but the PC's not going away. Not by a long shot.

It'll be smaller, faster, cheaper, easier to use: These attributes are merely extensions, all of trends visible for almost two decades. And sure, we'll have lots of smart gizmos ("info appliances") for smaller, more specific tasks. We don't need full-power PCs for many of the daily tasks we undertake; the PalmPilot's success is only the most visible example of the benefits of miniaturization, specialization, and simplification.

But if "post-PC" is supposed to mean "no PCs," then excuse me, but that's hogwash. The PC—evolved, refined, adapted, focused, greatly increased in power and functionality—is going to be around for a long time to come. 

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Where the Chips Fall

The IBM PC once ran at less than 5 megahertz. In a few weeks, we'll be at 500 MHz—and software still seems slow. There is now a wider variety of CPUs available than just the 1981-era 4.77-MHz Intel 8088. Here's a rundown of what we will see this year on the desktop and in notebooks:

Pentium MMX. It's gone from the desktop. But the Pentium MMX is still used in a few notebook lines at 233 MHz, 266 MHz, and 300 MHz, because it draws somewhat less power than the mobile Pentium II.

Pentium II. The Intel Pentium II (Deschutes) started life in early 1998 at 233 MHz and has topped out at 450 MHz. That's the end of the road for the PII as we know it.

Katmai. Around March, Intel will unveil its Pentium II follow-on with 70 additional floating-point multimedia instructions, called Katmai New Instructions (KNI). Think of KNI as MMX, Part II. The chip debuts at 450 MHz and 500 MHz; well-equipped systems will sell for \$2,000 to \$3,000. We expect Katmai to reach 600 MHz and possibly 700 MHz by year's end. Intel cites speech recognition, 3-D games, video encoding, and image processing as KNI beneficiaries. In other words, KNI will have clear benefits for gamers and home users and some benefit for some business users. Regardless, everyone benefits from the faster CPU speeds.

Celeron. This has become a decent chip with a big PR problem. In its initial 266-MHz and 300-MHz cacheless versions, Celeron was a gutless wonder. Now the 300-MHz and 333-MHz versions (Mendocino) have 128K of Level 2 cache built into the CPU die, running at full CPU speed, which is almost as good as the 512K of off-CPU L2 cache the big-brother Pentium II CPU has built into the chip packaging. Expect Celeron to reach 366 MHz shortly, still using a 66-MHz system bus. Around midyear there should be a 400-MHz Celeron with a 100-MHz bus using the Whitney chip set, and then a version with KNI. Also, the on-die cache will increase to 256K. Celeron will top out at 450 MHz or 500 MHz by year's end.

Mobile Celeron. Just released for notebooks, mobile Celeron is out at 266 MHz and 300 MHz (for details, see "The Newest Value Notebooks" in this issue). Intel's hope was that vendors could build basic notebooks for \$1,500, but most vendors found \$1,750 was the cheapest they could go without em-

barrassing themselves. Some are waiting for Banister, a cost-cutting chip set that replaces hardware functions (audio and modem) with software. The mobile Celeron uses less power than the mobile Pentium II.

Coppermine. Intel will turn on the mobile computing afterburners in the fall when it shrinks the manufacturing process from 0.25 microns to 0.18 microns. The impact: a 400-MHz system with KNI and a new form of power management (code-named Geyserville) that will make bigger distinctions between docked use and mobile, battery-powered use.

AMD K6. The K6-2 is the dominant chip among sub-\$1,000 PCs, with clock speeds ranging from 333 MHz to 400 MHz. The K6-2 performs roughly on a par with a Celeron or Pentium II of the same clock speed. The K6-3, just arriving now, adds an on-die 256K L2 cache for more performance. We expect the K6 to make inroads into business this year.

AMD K7. Due midyear at 500 MHz, the K7 should match and possibly surpass Intel's Katmai CPU at the same speed. Performance leadership may fall to the vendor that has the faster clock speed; Intel could push Katmai to 700 MHz in 1999.

Cyrix. The cheapest PCs use MII. Due this year is a new chip, Jalapeno, with integrated graphics.

Even as CPUs move forward, basic buying strategy should remain constant. To wit, if you want the best bang for the buck, look to buy one or two CPU levels down from the top, meaning a 350-MHz or 400-MHz CPU today. The KNI processors show great promise, but they won't turn your Pentium II into a technological dead end. Among basic PCs, you won't go wrong with either the AMD K6 or Intel Celeron. At any price, you'll get a balanced system if you put your money into more memory (get 64MB; consider 128MB), a fast hard disk (not just a big one), and a decent monitor. If you're planning to surf the Web, put your discretionary dollars into a moving van and find a neighborhood with cable modem or DSL service. As realty agents say, the only thing that matters is location, location, location. **PC**



We expect the Katmai to reach 600 MHz and possibly 700 MHz by year's end.

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THE NEWEST *Value* Notebooks

New mobile processors promise faster performance at better prices.

Do they deliver?

By Cade Metz

Buying an inexpensive portable PC no longer means settling for a dated processor. In January, both AMD and Intel announced new chips to bring greater processing power to the value notebook market: low-voltage, mobile versions of the AMD K6-2 and Intel's Celeron. If you're willing to spend more, you may be interested in the new, high-end 366-MHz Pentium II processor (see First Looks, page 41).

We had heard that Celeron systems would cost about \$1,500, but we found that although they do cost \$500 to \$1,000 less than Pentium II units, you still have to pay \$1,700 or more for them. In fact, Dell has outfitted its system with high-end components (such as a 13.3-inch TFT screen)

and aims it at power-hungry users. If you're not as power-hungry, you can save \$200 to \$300 and get good performance with an AMD K6-2 unit. For

equal or higher performance from an AMD unit, spend \$100 and add RAM; you'll still save money.

If you're on a tight budget and need a system now, consider a Pentium MMX unit. We found that performance was within 25 percent of that of Celeron systems—a noticeable difference on some applications—but you save as much as \$400 to \$500. Adding more memory here, too, will bring you up to par with Celeron performance. These systems won't be around for much longer, however.

We reviewed three Celeron systems, one K6-2 unit, and one Pentium MMX, and we looked at a similarly equipped low-end Pentium II/233 unit for comparison. The Celeron units—which came from Compaq, Dell, and Gateway—cost from \$1,649 to \$1,949 with 32MB of RAM. WinBook's \$1,598 K6-2/300 unit and its \$1,498 Pentium

Our Contributors: CADE METZ is a senior writer at *PC Magazine*. RICH FISCO was the project leader, and ANUSH YEGYAZARIAN was the associate editor in charge of this story.

Ratings

The *road warrior* rating reflects a notebook's aptitude for road work. Key factors include battery life, travel weight, system size, screen type and size, and communications features such as integrated modems. In **desktop replacement**, we look for systems offering a large screen with high resolution, multimedia features, good performance, and a large hard disk.

Our new **ease of use** rating is made up of nearly 200 items covering **setup** and **getting started**, **usability**, and **troubleshooting and support**. To determine the setup rating, we examine the on-disk and paper documentation, look for labeled ports, and consider the guidance given for setting up communications. For usability, we examine the keyboard and pointing device, and check the ease of swapping modules or batteries, the unit's sleep modes, and more. The troubleshooting and support rating takes into account a vendor's service policy, and information available on a vendor's Web site, among others.

Pick Your Trade-Off

Celeron systems give you larger screens and larger hard disks for your extra \$300 to \$600. Battery life is about the same, however, and you probably won't notice the difference in performance. If you need the very fastest systems, and are willing to pay the premium, look for the new Pentium II units, now at 366 MHz.

CPU: Celeron/300
Screen: 12.1" SVGA TFT
or 13.3" XGA TFT
Hard disk: 3.1GB or 3.9GB
System weight: 6.5 to 7.5 lbs.
Battery type: Lithium ion
Battery life: 3.00
Winstone score: 10.0
\$1,800-\$1,950

Celeron

CPU: AMD K6-2/300
Screen: 12.1" SVGA TFT
Hard disk: 2GB
System weight: 7 to 8 lbs.
Battery type: Lithium ion
Battery life: 3.00
Winstone score: 9.0
\$1,500-\$1,600

AMD K6-2

MMX

CPU: Pentium MMX/233
Screen: 12.1" SVGA DSTN
Hard disk: 2GB
System weight: 7 to 8 lbs.
Battery type: Lithium ion
Battery life: 3.00
Winstone score: 8.4
\$1,200-\$1,400

Pentium II

CPU: Pentium II/366
Screen: 14.1" XGA TFT
Hard disk: 6 to 8GB
System weight: 7 to 9 lbs.
Battery type: Lithium ion
Battery life: 3.00
Winstone score: 16.5
\$3,500-\$4,500 (64MB)

Ratings

	ROAD WARRIOR	DESKTOP REPLACEMENT	EASE OF USE	Setup	Usability	Troubleshooting/ support
Compaq Armada 1500c (Celeron/300)	Poor	Fair	Poor	Poor	Fair	Fair
Dell Inspiron 3500 (Celeron/300)	Fair	Fair	Poor	Poor	Fair	Fair
Gateway Solo 2500SE (Celeron/266)	Fair	Fair	Fair	Poor	Fair	Fair
EDITOR'S CHOICE WinBook XL 300 TFT (AMD K6-2/300)	Poor	Fair	Fair	Fair	Good	Fair
WinBook XL 233 DSTN (Pentium MMX/233)	Poor	Fair	Fair	Fair	Good	Fair

MMX/233 unit had 64MB of RAM; we also tested each with 32MB of RAM.

For this roundup, we just missed getting Compaq's \$1,799 K6-2 Presario laptop (whose configuration was similar to that of the Armada unit reviewed, but with 64MB of RAM). Celeron portables should also be available soon from HP, IBM, Toshiba, and others.

Using PC Magazine Labs' ease-of-use script, which examines nearly 200 items, we rated how easily each unit could be set up, operated, and serviced. The WinBook systems scored highest, providing fairly complete user guides, modest service offerings, and some minor amenities. WinBook's Web site, however, lacks the extensive information posted by others here. Dell's site is particularly noteworthy, offering system-specific diagnostic tools, information, and drivers. Compaq's Web site is also good. Like WinBook's site, the Gateway home page is rather slow to load but affords an ample supply of tutorials and support files. All companies needed improvement in documentation, help with attaching peripherals, and accessing the Internet. See our Ratings table for complete results.

SO WHAT DO YOU GET?

These Celeron systems are typical value notebooks, which means there are trade-offs. Though the \$1,800 Compaq system offers the largest disk in the roundup (3.9GB) and a modular drive bay, it

Editors' Choice

• WinBook XL 300 TFT



The Editors' Choice—winning WinBook XL 300 TFT combines solid performance with good features and a 3-hour battery life—all for \$1,598 (direct).

This AMD K6-2/300-based system is a true value. It comes with all the components you need: a 12.1-inch TFT screen, a 2GB hard disk, lithium ion battery packs, and 64MB of RAM. You can also use both a touch pad and a pointing stick; the unit has both. A 56K modem is built-in, as are a floppy disk

drive and a 20X CD-ROM drive, so you don't need to swap out drives. The unit has an 8.5-pound travel weight and a one-year warranty.

For top battery life, consider the \$1,649 Gateway Solo 2500SE. With the optional lithium ion pack (\$50), this Celeron/266-based unit should last over 5 hours.

weighs 8.4 pounds and has a low battery life because of its less expensive nickel hydride battery. The Dell unit has a large, 13.3-inch screen for presentations and a three-year warranty but costs nearly \$2,000. The \$1,649 Gateway system, priced below the others even with a lithium ion battery (a \$50 option), seems the best Celeron choice, especially if you want top battery life. Nonetheless, it has a 2GB disk and slight suspend/resume problems.

The \$1,598 K6-2-based WinBook XL 300 TFT carries the same size hard disk and screen as the Gateway unit but has 64MB of RAM and a built-in modem.

The best bargain among the tested systems (and our Editors' Choice), this three-spindle unit has dual pointing devices, an adept keyboard, and a 3-hour battery life.

THE TECHNOLOGY

The mobile Celeron is manufactured on a 0.25μ process and runs with a 66-MHz bus. The chip has a Pentium II core but adds 128K of full-speed, on-board L2 cache. Such a fast cache makes a big difference. With it, the three Celeron units just managed to outperform our Pentium II/233 reference system. With all systems at 32MB of RAM, the Celerons scored 12 to 18 percent higher under Winstone than the K6-2 WinBook system. As expected, however, the Celeron units' performance was well behind that of the first wave of 366-MHz Pentium II (Dixon) notebooks, which benefit from 256K of integrated full-speed cache.

The 266- to 333-MHz K6-2 has a lower core voltage than the mobile K6 yet provides the 3DNow! instruction set and support for a 100-MHz memory bus. The K6-2 WinBook system uses a Socket 7 chip set and can't take advantage of the faster bus, but the unit still had a 7 percent higher Winstone score than its Pentium MMX-based sibling.

LOOKING AHEAD

New Pentium IIs are the new high end, while Celerons and K6-2s are supplanting

Performance/Features Ranking

Our Editors' Choice, the WinBook XL 300 TFT, offers a terrific balance of features, performance, and price. Based on the K6-2 300-MHz CPU, the XL 300 TFT sells for \$1,598, which includes 64MB of RAM, a 12.1-inch TFT screen, and a 2GB hard disk. Battery life was good, at 3:00, and the unit's 8.5-pound travel weight is average for value notebooks. This three-spindle machine also comes with a built-in 56-Kbps V.90 modem.

Packed with features, the Dell Inspiron 3500 earned the highest performance/features score of this group. At \$1,949, it is also the most costly system, but you get a 13.3-inch XGA TFT screen and a 3.1GB hard disk as well as good battery life; the unit lasted for 3:09 on the 2D BatteryMark 2.0 test. It was also a good performer on our other tests. The Inspiron's three-year warranty is the best here.

1	Dell Inspiron 3500	\$1,949
2	WinBook XL 300 TFT	\$1,598
3	Compaq Armada 1500c	\$1,800
4	WinBook XL 233 DSTN	\$1,498
5	Gateway Solo 2500SE	\$1,649

Red type denotes Editors' Choice

DATA POINTS

We put these products in rank order based on performance/features scores. The Business Winstone and BatteryMark 2.0 scores make up 30 percent of each performance/features score. The warranty makes up 8 percent. Hard disk size, screen size, and key size account for 26 percent. The balance of the score reflects such features as internal and external screen resolution, screen type, modem speed, and travel weight.

Pentium MMXs and slower Pentium IIs at the low end. The latter two, however, will still be available until mid-1999. Intel has even announced a 300-MHz Pentium MMX, used in such laptops as the Toshiba Portégé 7020.

Later in 1999, AMD should introduce its *Mobile Sharptooth* chip, a version of the K6-2 with 256K of full-speed, on-board cache. Intel will counter with *Coppermine*, a chip manufactured on a 0.18μ process that incorporates Katmai New Instructions and uses a 100-MHz bus. With the new mobile Celeron and mobile K6-2, exciting things are already afoot.

Compaq Armada 1500c

Celeron/300, 12.1" TFT, 3.9GB hard disk, 32MB SDRAM, 7.3 pounds. Battery: 2:01. Winstone: 10.6. \$1,800 street. Houston: 800-345-1518, 281-370-0670; www.compaq.com.

● The Compaq Armada 1500c offers just a smidgen more performance than the Gateway unit but costs \$150 more. It has a shorter battery life and a heavier weight, although it does have 2GB more disk space than the Gateway. This system is also the only machine we reviewed capable of concurrently housing a CD-ROM



drive and two batteries—which you'll need given its 2:01 life with a single nickel hydride battery. Compaq typically earns excellent service and support ratings for desktops, but for notebooks it received one below-average rating (for reliability) and four average ratings in our latest Service and Reliability Survey.

The Armada is rather bulky, weighing

8.4 pounds with AC adapter and measuring over 2 inches thick, though you can house your CD and floppy disk drives internally at the same time. You can swap the floppy disk drive for the second battery (\$186 option). Both its PC Card bay and its rear ports are uncovered and thus susceptible to damage. Compaq does, however, offer a comfortable keyboard and a serviceable SVGA display.

Compaq consolidates power management under Windows, so you needn't go to BIOS at all. The unit's suspend-to-disk mode, however,

can be entered only with a button press; you can't set the machine up to enter suspend-to-disk automatically after a period of inactivity.

We weren't able to grade Compaq's setup poster or restore CD (the company failed to send them), but its online documentation was helpful. The machine's warranty extends for one year.—CM

SUMMARY OF FEATURES

See www.pcmag.com for interactive views

Notebooks

REVIEWED SYSTEMS COMPARISON SYSTEM

■ YES ■ NO

	Compaq Armada 1500c	Dell Inspiron 3500	Gateway Solo 2500SE	WinBook XL 300 TFT	WinBook XL 233 DSTN	Gateway Solo 2500SE PII 233
Price of tested configuration	\$1,800 street	\$1,949 direct	\$1,649 direct	\$1,598 direct	\$1,498 direct	\$1,899 direct
Processor	Celeron/300	Celeron/300	Celeron/266	AMD K6-2/300	Pentium MMX/233	Pentium II/233
LCD panel	12.1 TFT SVGA	13.3 TFT XGA	12.1 TFT SVGA	12.1 TFT SVGA	12.1 DSTN SVGA	12.1 TFT SVGA
System weight/Travel weight (pounds)	7.3/8.4	8.3/7.3	7.0/7.9	7.0/8.5	7.0/8.5	7.0/7.9
Dimensions (HWD, in inches)	2.1 x 12.0 x 9.4	1.4 x 12.4 x 9.8	1.9 x 11.5 x 9.3	2.0 x 12.2 x 9.8	2.0 x 12.2 x 9.8	1.9 x 11.5 x 9.3
Installed/maximum system RAM	32MB / 160MB SDRAM	32MB / 256MB SDRAM	32MB / 288MB SDRAM	64MB / 128MB EDO DRAM	64MB / 128MB EDO DRAM	32MB / 288MB SDRAM
Installed pipelined-burst L2 cache	128K	128K	128K	256K	256K	512K
Pointing device	Touch pad	Touch pad	Touch pad	Touch pad, pointing stick	Touch pad, pointing stick	Touch pad
Number of spindles	3	2	3	3	3	3
Chip set	Intel 440BX	Intel 440BX	Intel 430TX	Intel 430TX	Intel 430TX	Intel 430TX
Graphics chip set	Chips & Technologies 69000	NeoMagic MediaMagic 256AV	NeoMagic MagicGraph 128XD	Chips & Technologies 6554	Chips & Technologies 6554	NeoMagic MagicGraph 128XD
Graphics memory	2MB SDRAM	2.5MB SGRAM	2MB DRAM	2MB EDO DRAM	2MB EDO DRAM	2MB DRAM
Hard disk capacity	3.9GB	3.1GB	2GB	2GB	2GB	2GB
Floppy disk drive	Swappable	Swappable	Internal	Removable	Removable	Internal
CD-ROM speed	24X	24X	20X	20X	20X	20X
Battery type	Nickel hydride	Lithium ion	Nickel hydride	Lithium ion	Lithium ion	Lithium ion
56K (V.90) modem type/price	Integrated/Included	Integrated/\$59	PC Card/\$100	Integrated/Included	Integrated/Included	PC Card/\$100
Microphone jack/speaker jack	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Line-in/line-out jack	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
NTSC video-in/video-out	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Infrared (IrDA)/USB ports	1/1	1/1	1/2	1/2	1/2	1/2
External keyboard and mouse ports	Shared	Shared	Shared	Shared	Shared	Shared
24-hour, 7-day live technical support	■	■	■	■	■	■
Standard warranty on parts/labor	1 year	3 years	1 year	1 year	1 year	1 year
On-site service charge	N/A	\$149 (3 years)	N/A	N/A	N/A	N/A

All systems include one Type III or two Type II PC Card slots, stereo speakers, a microphone, a CardBus socket, and Zoomed Video support. N/A—Not applicable: The product does not have this feature.

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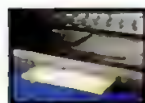
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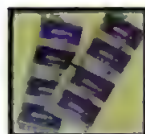
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Dell Inspiron 3500

Celeron/300, 13.3" TFT, 3.1GB hard disk, 32MB SDRAM, 6.3 pounds. Battery: 3:09. Winstone: 10.0. \$1,949 direct. Austin, TX; 800-388-8542, 512-338-4400; www.dell.com; 510 at www.pcmag.com/infolink.

● Though priced higher than the others here, the Dell Inspiron 3500 also gives you more. Thinner and lighter than the others here, the Inspiron nonetheless offers a 13.3-inch XGA screen (the largest in the roundup), a 3.1GB disk, good performance, and a good battery life. Unlike some, however, it does require you to swap between the floppy disk and CD-ROM drives. Our tested unit lacked a modem (a built-in 56-Kbps V.90 modem is \$59 extra) but was otherwise exemplary. Dell was also one of two notebook vendors to earn top scores across our Service and Reliability Survey.

The system provides two front drive bays: one that holds the unit's primary battery and one that lets you swap various components in and out. The Inspiron ships with modular floppy disk and 24X CD-ROM drives, but you can also purchase a second battery (\$129), a DVD drive (\$199), and a Zip Drive (\$149). The

main chassis also provides easy access to memory and the system's hard disk.

The Inspiron (which has a 7.3-pound travel weight) delivered the roundup's best mix of performance and battery life. The Compaq and Gateway PCs scored slightly higher under Winstone, but they couldn't match the Dell's 3:09 BatteryMark result.

The Dell PC's power management functions are adequate. Unlike most notebooks, the Inspiron doesn't let you input conflicting PM data under disparate Windows and BIOS-based interfaces, but you must still toggle between Windows and the BIOS to make use of all PM capabilities. The unit's getting-started documentation and printed manual were not sent to us, but we found the on-disk information well organized and useful. —CM

Gateway Solo 2500SE

Celeron/266, 12.1" TFT, 2GB hard disk, 32MB SDRAM, 7.0 pounds. Battery: 2:30. Winstone: 10.5. \$1,649 direct. N. Sioux City, SD; 800-315-2536, 605-232-2000; www.gateway.com; 511 at www.pcmag.com/infolink.

● With the new Gateway Solo 2500SE, the company has improved on an already good



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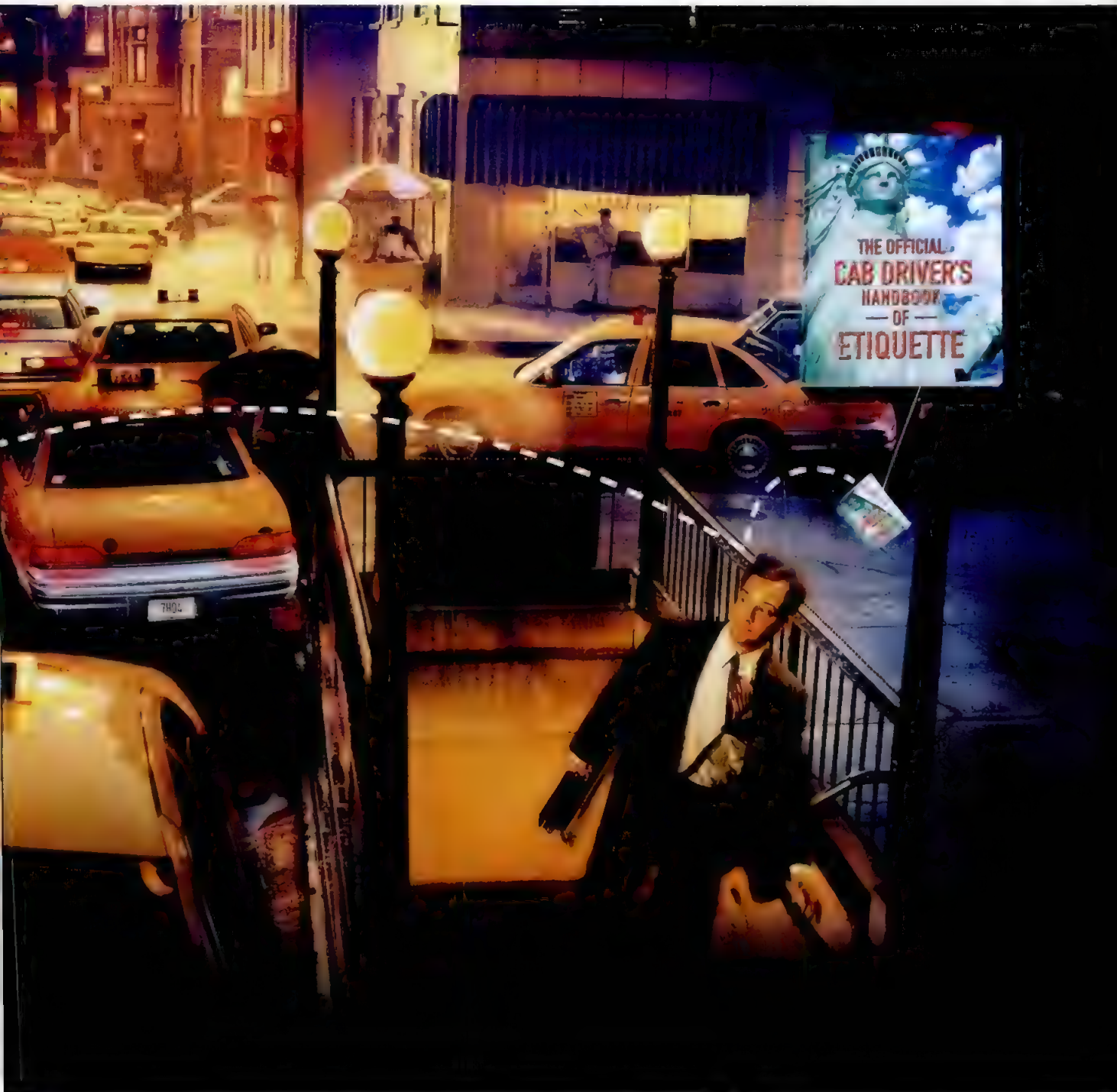
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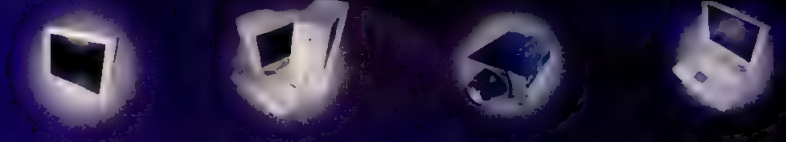
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product. Like most other units in this roundup, the Solo has a three-spindle design, but it manages to be the lightest of these; it is also a top performer despite using a 266-MHz Celeron instead of the 300-MHz model. Its battery life was 2:30, however, because of its nickel hydride battery. The lithium ion battery pack costs \$50 but doubles your battery life. Gateway was one of only two notebook vendors to receive all top scores on our most recent Service and Reliability Survey.

Processor aside, the system is largely the same as it always was. Weighing 7.9 pounds with AC adapter, it houses both a floppy disk and a 20X CD-ROM drive. The keyboard and active-matrix display are respectable, and the touch pad is easy to use. (A pointing stick is optional.) The floppy and hard disk drives can be easily removed with a screwdriver, as can the memory, which is



accessed via a screw-fastened door on the unit's underside. The unit also has an NTSC/Pal video-out port.

Equipped with a 9.6-volt nickel hydride battery rather than the 14.8-volt lithium ion battery also available for the Solo, the unit scored 2:30 under BatteryMark as opposed to the 5:13 produced by the Pentium

II-based Solo 2500, used as a comparison system. The unit's power management paradigm is also problematic: Bringing it out of suspend-to-RAM mode took 35 seconds, and it lacks a suspend-to-disk mode.

Though much of its documentation was good, the unit lacks a wizard to help you make an Internet connection, and some of its ports are not well labeled.—CM

WinBook XL 300 TFT, XL 233 DSTN

WinBook XL 300 TFT: AMD K6-2/300, 12.1" TFT, 2GB hard disk, 64MB EDO DRAM, 7.6 pounds. Battery: 3:00. Winstone: 9.0 (with 32MB). \$1,598 direct. **WinBook XL 233 DSTN:** Pentium MMX/233, 12.1" DSTN, 2GB hard disk, 64MB EDO DRAM, 7.6 pounds. Battery: 3:00. Winstone: 8.4 (with 32MB). \$1,498 direct. Columbus, OH; 800-651-4518; www.winbook.com; 512 at www.pcmag.com/infolink.



With the WinBook XL, WinBook has created a modest but capable three-spindle unit whose ever-decreasing price has redefined the market. The line has been home to the industry's sole sub-\$1,000 mainstream portable (a \$999 Pentium MMX model available for purchase only over the Web) since last fall. Its XL 300 TFT, based

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BENCHMARK TESTS

Value Notebooks



Secondary cache speed is more important than cache size: The fastest processor was the Celeron, whose full-processor-speed 128K cache beat out a Pentium II half-speed system that had four times the L2 cache.

The **ZD Business Winstone 99** score shows differences in overall system performance. Notebook hard disks and graphics chip sets are not as fast as their desktop counterparts, contributing to lower Winstone scores. Some notebooks still use EDO DRAM instead of faster SDRAM, which also results in notebooks performing more slowly than desktops with the same processors.

Among the tested group, systems using processors based on the Intel Pentium II core, either Celeron or Pentium II, performed extremely closely. There was only a 7 percent difference between the top-scoring Celeron/300-based Compaq Armada 1500c and the Pentium II/233-based Gateway Solo 2500SE that we used for comparison. The WinBook XL 300 TFT unit using the AMD K6-2/300 fell behind the leaders by about 15 percent, edging out only the Pentium MMX/233-based WinBook XL 233 DSTN system.

Our **CPUmark32** test shows the differences among processor

scores, their cache and speed. The Celeron-based systems come with 128K of integrated L2 cache running at full processor speed. That's enough to make them equal to the Pentium II/233-based Gateway system we used for comparison, which has 512K of off-die L2 cache running at half the processor speed. While the K6-2/300-based WinBook has the most L1 cache, 64K compared with 32K for the Celeron and Pentium II, the system came with 256K of off-die L2 cache that runs at the 66-MHz system speed. The slower cache made the difference for the AMD K6-2/300 unit, placing it behind the two 300-MHz Celeron-based systems.

For road warriors, the **ZD BatteryMark 2.0** gives a good measure of useful battery life. Lithium ion still has the highest electrochemical potential among notebook batteries, and the two Gateway notebooks prove that point. The Celeron-based Gateway unit came with a nickel hydride battery, while the Pentium II comparison system came with a lithium ion model. Because lithium ion is lighter and denser than nickel hydride, the battery in the Pentium II system has a higher capacity, leading to a battery life more than double that of the test unit.

How We Tested

We tested all notebooks with Windows 98 and 32MB of RAM. Before testing, we prepared each system following a standard procedure to create a common testing state for all notebooks. We stripped each system's start-up configuration of all processes or tasks except for Systray, Explorer, and graphics card control panels. We set the display to the system's maximum internal resolution, 800-by-600 or 1,024-by-768 with 65,536 colors and small fonts. We also disabled power management features. We defragmented hard disks before each test and let Windows 98 manage virtual memory settings. We used the vendor's provided graphics driver for all

systems. For our ZD BatteryMark 2.0 test we used standard power-management settings during testing: 2 minutes for hard disk time-out (or the closest value available), and Auto or Fast CPU speed. BatteryMark also uses Microsoft Advanced Power Management where possible to automate procedures and provide information.

For more detailed information on these ZD benchmark tests, go to www.pcmag.com/howwetested.

High scores are best. Bold type denotes first place among reviewed products. ■ denotes Editors' Choice.			
	ZD Business Winstone 99	ZD CPUmark32	ZD BatteryMark 2.0 (Hours: minutes)
Compaq Armada 1500c (Celeron/300)	10.6	606	2:01
Dell Inspiron 3500 (Celeron/300)	10.0	619	3:09
Gateway Solo 2500SE (Celeron/266)	10.5	563	2:30
■ WinBook XL 300 TFT (AMD K6-2/300)	9.0*	517	3:00
WinBook XL 233 DSTN (Pentium MMX/233)	8.4*	404	3:00
Gateway Solo 2500SE PII 233** (Pentium II/233)	9.9	610	5:13

* With 32MB RAM. When tested with its standard 64MB, the AMD-based unit scored 11.3, and the Pentium MMX-based unit scored 10.5.

** Reported for comparison.

▲ **Systems based on the mobile Celeron with 128K of full-speed L2 cache swept the field on our Winstone tests. Cache speed, not**

size, made the difference here (some other units had two to four times more cache). Lithium ion batteries lasted longest on

our test. The Compaq unit was especially hindered: Its nickel hydride battery lasted about an hour less than the others.

on the mobile version of the AMD K6-2 chip, earns our Editors' Choice. The lowest prices in this roundup, reasonable performance, and good battery life recommend the WinBook units, though a dual-scan passive-matrix screen in the Pentium MMX model detracts. WinBook received four average and one below-average rating (for units needing repair) on our most recent Service and Reliability Survey.

Though WinBook sells these two systems only with 64MB of RAM, we downgraded them to 32MB during testing in order to have a level testing field. With 32MB, the AMD model performed well;

with its standard 64MB of RAM, it earned the highest score in the roundup. The Pentium MMX model's score was below average with 32MB; but with 64MB, it posted one of the top scores in the roundup.

Each WinBook unit weighs 8.5 pounds with AC adapter and measures 2 inches thick. The lithium ion battery used by each system provided 3:00 of life on our tests for each model. As the systems are configured, you get both nickel hydride and lithium ion batteries; models are available with nickel hydride only (\$150 less) but not with lithium ion only. Power management functions were average: Returning to Windows after

suspending to RAM took us nearly 20 seconds, and the Windows PM interface does not update the BIOS, although Windows settings do override the BIOS ones.

Each unit includes a built-in 56-Kbps V.90 modem and a TV-out port. The floppy disk drive and the 2GB hard disk can be removed using a screwdriver but cannot be swapped for other components. The AMD-based WinBook system came with both a touch pad and a pointing stick that can be used simultaneously.

We were impressed with WinBook's extensive documentation and recovery CDs.—CM



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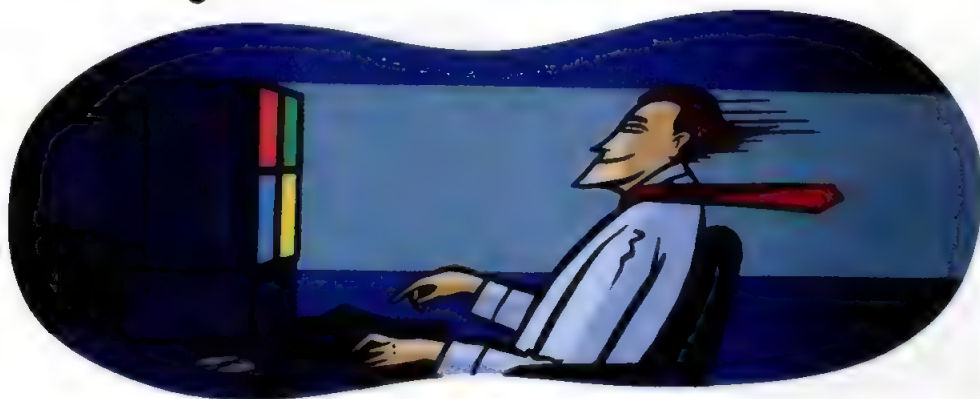
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make your PC



work better

Programs that conflict with each other, lost Internet connections, and sometimes the whole thing comes crashing to a halt—this is a productivity tool? ■ Well, we're here to help. At PC Magazine Labs, we deal with the various problems that arise on a regular basis, and through our experience, offer you some of our favorite tips to help you fix, work around, or maybe just cope with your computer. ■ We'll help you speed up your system, make Windows look the way you want it, diagnose system crashes, improve your Internet connections, and more. ■ Read on and learn about how to deal with some of Windows' greatest frustrations and how to make your Windows system run more smoothly than ever before.

Top 10 Tips for Tinkering with Your PC

1 Back up. Backing up your entire hard disk might be impractical, but make sure all your data files, customization files, Registry, and application configuration files are backed up. Don't just do it once—make it a regular habit.

2 Make sure you have up-to-date Windows start-up disks (Control Panel | Add/Remove Programs | Startup Disk). Be sure to have copies of all your device drivers handy as well.

3 Store your user names and passwords on paper and keep them somewhere safe. If you forget your Windows password, having it in a file on your PC won't help you.

4 The Windows Registry is not something to be fooled with unless you have some experience using it already. Even if you are familiar with the Registry, you should be extremely careful not to stray from the task at hand or you'll risk severely damaging your system.

5 Did we mention that you should back up your PC?

6 Partition your hard disk. Put your data files on a separate volume from your operating system and programs. Put a copy of your operating system on a separate hard disk as well. It will make backups and reinstallation of

software much easier.

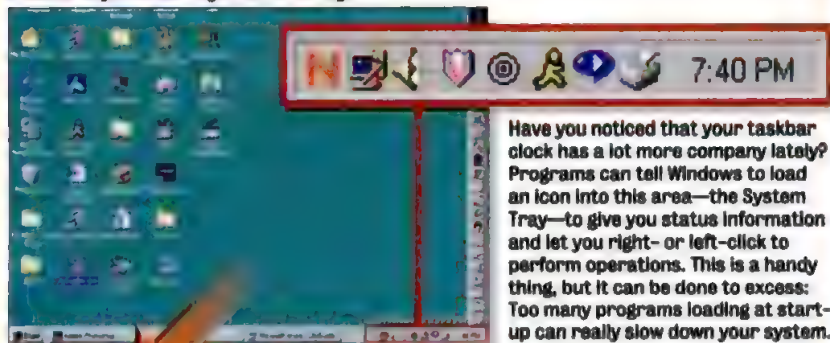
7 Paste a copy of each program's serial number to its CD jewel case, or use a permanent marker to write the number on the CD itself (on the label side!).

8 If you're on a network, keep a copy of all your network settings (IP address, DNS, gateway, network card settings, and so on) handy.

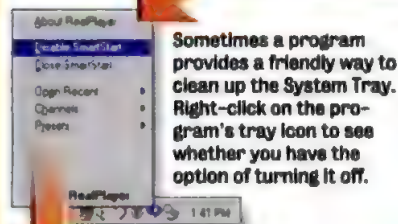
9 If it ain't broke, don't fix it. If you have no compelling reason to open the case or upgrade your operating system or applications, don't.

10 No kidding, we really mean it: Backup is important.

Clean Up Your System Tray

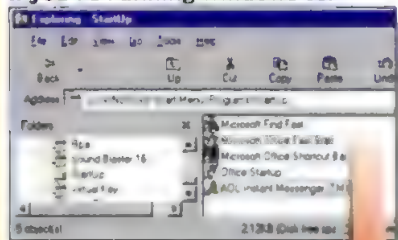


Have you noticed that your taskbar clock has a lot more company lately? Programs can tell Windows to load an icon into this area—the System Tray—to give you status information and let you right- or left-click to perform operations. This is a handy thing, but it can be done to excess: Too many programs loading at start-up can really slow down your system.



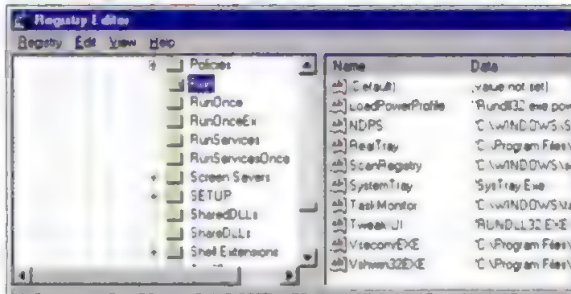
Sometimes a program provides a friendly way to clean up the System Tray. Right-click on the program's tray icon to see whether you have the option of turning it off.

If you're running Windows 95:



Go to the Windows Start Menu Programs\StartUp folder in Windows Explorer. You can add or remove programs here for start-up.

If your program wasn't in the StartUp folder, check the Registry. Go to Start | Run and type `regedit`. Go to the HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion section. Look for the Run key, which contains a number of strings—programs Windows loads. You can delete keys at your discretion.



Tweak UI to Speed Up Windows

Tweak UI, a utility that offers some helpful options to speed up Windows, also gives you impressive power to customize your desktop further than you can without it. UI is included on the Windows 98 CD under Tools\ResKit\PowerToy\Tweakui.inf; Windows 95 users can download the latest version at www.microsoft.com/windows/downloads/contents/wutoys/

`nttweakui/default.asp`. The utility installs itself as a Control Panel applet.

- Under the Boot tab in Tweak UI, you can prevent ScanDisk from automatically running at start-up, further speeding the boot process.
- Another way to use TweakUI to speed up your system is to uncheck all the check-box items in the Paranoia tab that clean up parts of your system, such as the Documents folder and your

Restart Windows Without Restarting Your Computer

When you need to restart Windows, here's how to cut short the sometimes lengthy reboot process. Launch Notepad and type the following line:



@EXIT

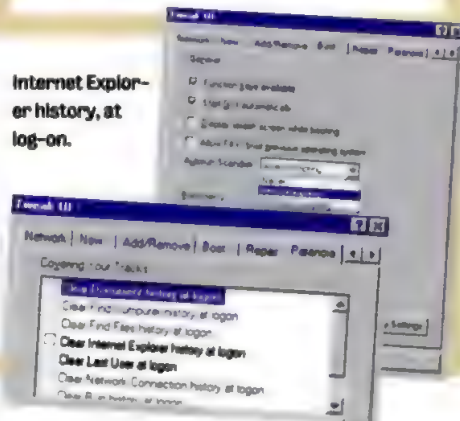
Save the file as `C:\Windows\Desktop\Restart.bat`. An icon for the file will show up on your desktop. Right-click on the icon; choose Properties, then the Program tab. Make sure the "Close on Exit" option is enabled. Click the Advanced button, and make sure that the MS-DOS mode option is selected and that the "Warn before entering MS-DOS mode" option is deselected. Click OK to close both dialog boxes. A second icon (Restart.pif) will be created. Double-click on this icon whenever you need to restart Windows.

Tidy Up Your Temp Folder

Clean up the temporary files in your `C:\Windows\Temp` folder that waste space and may slow start-up. Add the line

```
del
C:\Windows\Temp\*.tmp>nul
```

to your Autoexec.bat file to clean up this file every time you start your computer. If you're running Windows 98, you can run the System Configuration Utility, click on the Autoexec.bat file and on New (if you don't already have an Autoexec) or Edit (if you have this file), add the line, and then enable it. In Windows 95, you can typically find the Autoexec.bat file in the root directory of your C: drive. Open it in Windows Notepad and make the changes there.



Internet Explorer history, at log-on.

Start Menu

To customize your Start Menu, right-click on your taskbar and go to Properties | Start Menu Programs | Advanced. Because all the links in your Start Menu and Programs folders are just shortcuts in the file system, you can manipulate them as you would any other file hierarchy. The only folder in the view should be the Programs folder. Put shortcuts for frequently used programs in this view; they will show up above Programs on the Start Menu, giving you easy access.

If you're using IE4 or Windows 98, you can rearrange menu items and groups simply by left-clicking on the Start button and dragging and dropping within and between program groups. The one downside is once you rearrange menu items, the Start Menu stops sorting automatically. An easy way to fix this is grabbing *PC Magazine's* MenuZap utility from www.hotfiles.com.

One thing to keep in mind as you move things around in the Start Menu and Programs folders: Don't move any actual programs into these folders, only the shortcuts to them.

Customize the Send To Menu

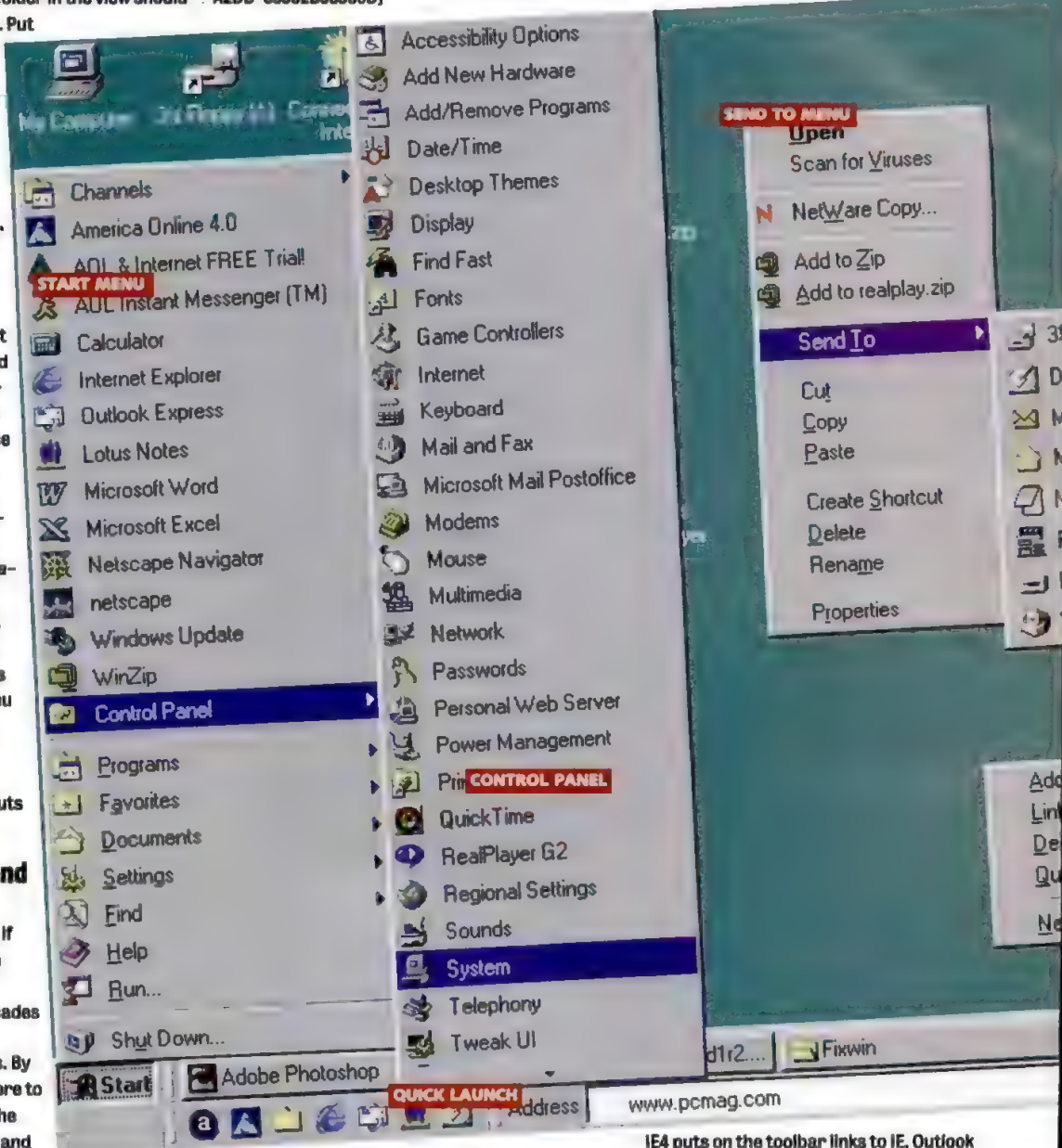
In Windows Explorer, if you right-click on an icon, there is a Send To option, from which cascades a list of links to certain programs and locations. By default, you get links there to your floppy disk drive, the Windows mail program, and possibly your Briefcase. You can add new programs to this list, and doing so can be very handy when managing files and folders. Here's how:

Open Explorer to C:\Windows\SendTo. You'll see the links you saw in the Send To menu. Delete the ones you don't want and add the ones you need.

Add Control Panel to the Start Menu

Open Explorer in the Start Menu folder by right-clicking on the Start button and choosing Explore. In the right-hand pane, right-click on an empty area and select New and Folder. In the field for the name, type this exactly: Control Panel.(21EC2020-3AEA-1089-A2DD-08002B30309D)

You can create similar cascading menus for your printers and Dial-Up Networking connections by following the same procedure with these folder names: Printers.(2227A280-3AEA-1089-A2DE-08002B30309D) Dial Up Net.(992CFFA0-F557-101A-88EC-00DD010CC48)

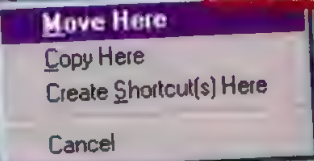


Quick Launch

The Start Menu is a great place to put programs, but for the small number of programs you use most, the Quick Launch bar is even easier and more convenient. Quick Launch is an extension to the Windows interface installed by IE4 and Windows 98. By default,

IE4 puts on the toolbar links to IE, Outlook Express, your channels, and a button called Show Desktop that minimizes all programs. You can remove any of these links by right-clicking on them and selecting Delete. To add new links to the toolbar, drag shortcuts (from the desktop or other folders) to the bar. Try not to add too many shortcuts to the Quick Launch bar; it will slow down system start-up.

Hold down the right mouse button instead of the left one. When you lift up, the default action will be in bold, but you'll be given the choice to move, copy, or create a shortcut.



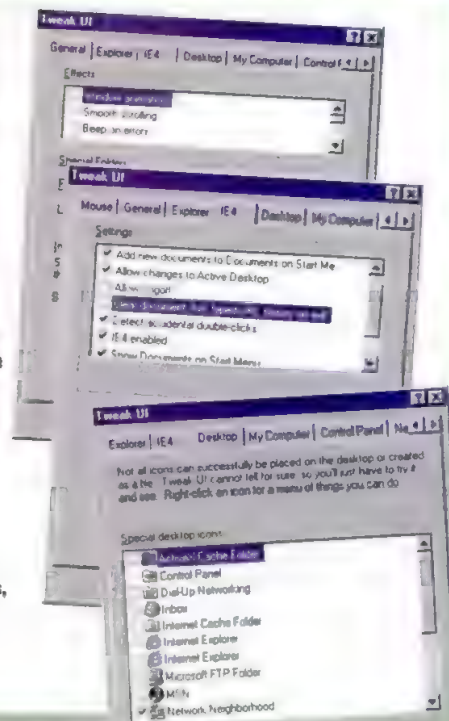
IE4 and Windows 98 users can also add new toolbars and other familiar items to the taskbar. Right-click on an empty part of the taskbar and select Toolbars from the menu. From here, you can add the Unks list from your IE favorites, the IE address bar itself, the shortcuts on your desktop, and even whole new toolbars.

Tweak UI is a utility that gives you impressive power to customize your desktop further than you can without it. It's included on the Windows 98 CD under \Tools\Reskit\Powertoy\Tweakui.inf. Windows 95 users can download the latest version at www.microsoft.com/windows/downloads/contents/wutvts/nttweakui/default.asp.

You can turn off various animations, smooth scrolling, and other bits of folderol under the General tab.

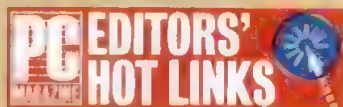
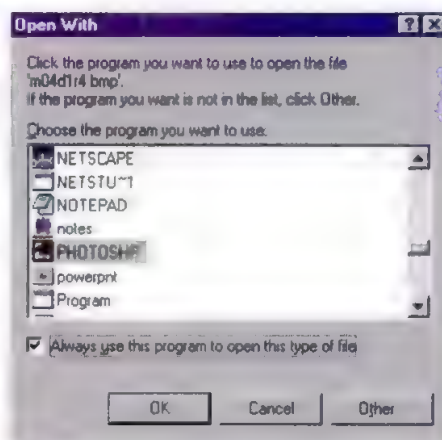
The IE4 tab lets you turn off Active Desktop for good, clean out your typed URL history, and remove the Favorites and Documents folders from the Start Menu.

The Desktop tab controls which special icons, such as MSN and Internet Explorer, appear on the desktop.



Does it drive you crazy when that image file you just got opens up in Microsoft Paint or Lview Pro instead of in your preferred image editor? Here's how you can make sure that never happens again:

In Explorer, select a file of the type you want to change. Hold down the Shift key, right-click on the selection, and choose Open With. In the dialog box that pops up, select the program you want to use to open the file type. Check "Always use this program to open this file," click OK, and off you go.



Join us online and share your Windows tips and tricks. Our five favorite responses will each win a T-shirt.

A wide range of free and subscription services are offered here, geared to fixing and providing information about Windows-related bugs.

www.zdnet.com/zdhelp/win_help/win_help.html

The Windows section includes advice, downloads, utilities, and tips for all of your Windows 95 and 98 problems.

For both Windows 95 and 98 solutions. It's intended primarily for intermediate to advanced users.

This site provides everything for the Windows user—from tips and tricks to the latest drivers and shareware.

Turn here for Microsoft's own site covering all of its products.

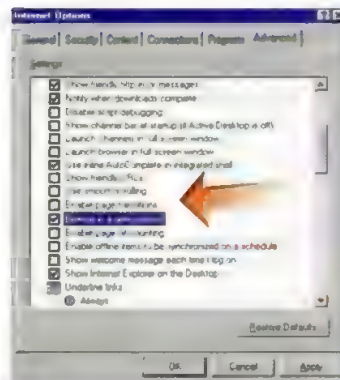
PREVENTS SYSTEM CRASHES

Run IE in a Separate Process

If you're running Windows 98 or running IE4 under Windows 95, you may notice that sometimes IE can bring your whole system down if it crashes. This may occur because, if you installed the Windows Desktop Update (meaning that IE replaced your Windows shell with itself), then Windows Explorer is running in the same process as IE. If IE goes, so does your system.

To prevent this occurrence, you need to run IE in a separate process from Windows Explorer. Microsoft warns that this might decrease general performance, but your browser shouldn't crash your system as often, so we think this is a good trade-off.

Go into Internet Options (on the View menu in IE4 and under the Tools menu in IE5) and click on the Advanced tab. Scroll down the Browsing section. Select **Browse in a New Process** by clicking on the checkbox. Then click OK, close IE4, and restart it.

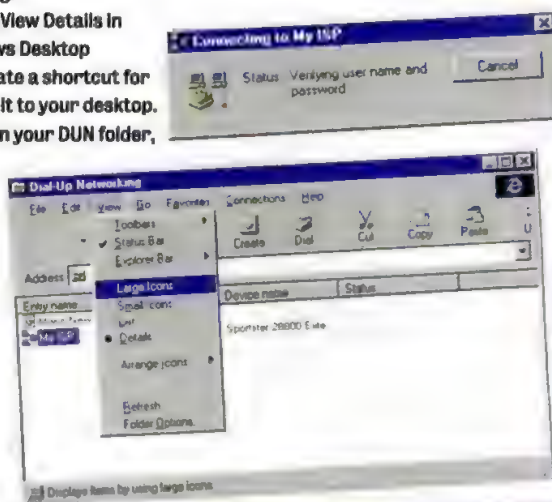


Dial-Up Networking Hangs While Trying to Connect

If this happens to you, you are likely a Windows 95 OSR2 user running IE4. The problem is a conflict with the View Details option in DUN and IE4 running as your Windows shell. Here's how to fix this documented bug:

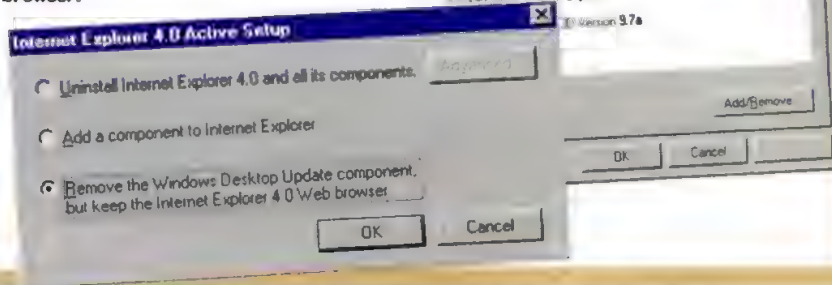
You need either to disable View Details in DUN or to uninstall the Windows Desktop Update component. First, create a shortcut for your DUN connection and add it to your desktop. You can find your connection in your DUN folder, which is In My Computer. Connect to the Internet with your new shortcut.

Go to Start | Programs | Accessories | Dial-Up Networking. In the View menu, deselect Details by choosing another view, such as Large Icons.



If you need to uninstall the Windows Desktop Update, go into the Control Panel, open Add/Remove Programs, click on Internet Explorer 4.0, and then click on the Add/Remove button.

In the IE4 Active Setup dialog box, click on "Remove the Windows Desktop Update component, but keep the Internet Explorer 4.0 Web browser."



Save Yourself

Though you may never be able to prevent crashes totally, a few safe computing practices will minimize crashes and crash damage. One problem occurs when the operating system or application expects one thing but gets another, such as when you've got a program using a CD or floppy disk that you remove before saving. Here are some hints to help you prevent crashes.

1 Always shut the PC down properly. Windows creates temporary files that need to be closed before you turn off your machine. If you just throw the switch, these files are left in limbo. Not only might you lose program data that has not been saved, but it's possible that badly written programs could be left in an unusable state.

2 When using Dial-Up Networking (DUN), don't physically disconnect your phone line from the PC before shutting down your connection. Depending on the application that's using DUN, Windows can hang waiting on the GDM port.

3 Let ScanDisk run during boot-up if your machine requires it.

4 Store data files on a different partition from the operating system. If Windows does crash and needs to be reinstalled, you won't lose data.

Find the Kernel of Truth in IE Crashes

Are you an Internet Explorer user? Have you ever seen the error message "IEXPLORE caused an invalid page fault in module Kernel32.dll"?

One of the more likely reasons is that there is at least one dynamic link library (DLL), a type of program file, located on the desktop. If so, you probably can't see it, because by default, Windows won't show such files. To make them visible, open My Computer by double-clicking on it. Select the View menu, then either Options or Folder Options (depending on your version of Windows). On the View tab, you will find an option to "Show all files." Select it. After you click OK, you may see new files, some with a DLL extension. Give each file a different type of extension or move it.

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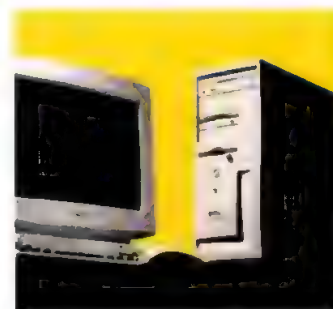
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Business Lease*: \$110/Mo., 36 Mos.

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DELL INSPIRON 7000 D300GT PENTIUM II PROCESSOR AT 300MHz FEATURING MMX TECHNOLOGY

All-in-One Multimedia Performance

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (384MB Max*)
- 4GB Ultra ATA Hard Drive
- Removable Combo 24X Max** Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- 3D Surround Sound and Hardware Wavetable
- 12-Cell Intelligent Lithium Ion Battery
- Deluxe Nylon Case
- MS Office 97 SBE (Call about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty†
- ★ Upgrade to 64MB SDRAM, add \$39.

\$2699

Business Lease*: \$102/Mo., 36 Mos.

 E-VALUE CODE: 04034-890126

DELL INSPIRON 3500 D266GT PENTIUM II PROCESSOR AT 266MHz FEATURING MMX TECHNOLOGY

Light Weight, Light Price

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 4.3GB Ultra ATA Hard Drive
- Modular 24X Max** Variable CD-ROM
- Modular Floppy Drive
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound and Software Wavetable
- 9-Cell Intelligent Lithium Ion Battery
- APC SurgeArrest Notebook Pro
- MS Office 97 SBE (Call about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty†

\$2379

Business Lease*: \$90/Mo., 36 Mos.

 E-VALUE CODE: 04034-890123

DELL INSPIRON 3500 D233XT PENTIUM II PROCESSOR AT 233MHz FEATURING MMX TECHNOLOGY

Light Weight, Light Price

- 13.3" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- Modular 24X Max** Variable CD-ROM
- Modular Floppy Drive
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound and Software Wavetable
- 9-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Call about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty†

\$1999

Business Lease*: \$76/Mo., 36 Mos.

 E-VALUE CODE: 04034-890119

DELL LATITUDE CPi D300XT PENTIUM II PROCESSOR AT 300MHz FEATURING MMX TECHNOLOGY

Network-Optimized Notebook

- 13.3" XGA Active Matrix Display
- 96MB EDO RAM (256MB Max)
- 4GB Ultra ATA Hard Drive
- Modular 24X Max** Variable CD-ROM
- Modular Floppy Drive
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound and Software Wavetable
- Intelligent Lithium Ion Battery with ExpressCharge™ Technology
- MS Windows NT® Workstation 4.0
- Touchpad
- 3-Year Limited Warranty†
- 1-Year NBD On-site⁴ Service

\$2999

Business Lease*: \$114/Mo., 36 Mos.

 E-VALUE CODE: 04034-790129

DELL LATITUDE CP M233T PENTIUM PROCESSOR WITH MMX TECHNOLOGY AT 233MHz

Network-Optimized Notebook

- 12.1" SVGA Active Matrix Display
- 32MB EDO RAM (128MB Max)
- 4GB Ultra ATA Hard Drive
- Modular 20X Max** Variable CD-ROM
- Modular Floppy Drive
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound and Software Wavetable
- Intelligent Lithium Ion Battery with ExpressCharge Technology
- MS Windows NT Workstation 4.0
- Touchpad
- 3-Year Limited Warranty†
- 1-Year NBD On-site⁴ Service

\$2199

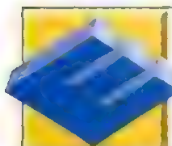
Business Lease*: \$83/Mo., 36 Mos.

 E-VALUE CODE: 04034-790121

DELL NOTEBOOK AWARD INFO™

- Two-time "A" rating in PC Magazine's Readers' Choice Awards for Service and Reliability.
- Latitude Line – PC Computing's "Best Overall" Rating Three Years.
- Inspiron 7000 D300GT – CNET Editors' Choice.

Advertised configurations vary from award-winning configurations.



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PEOPLE.

DELL POWEREDGE 2300 SERVER PENTIUM® II PROCESSOR AT 350MHz (DUAL PROCESSOR/RAID CAPABLE)	DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)	DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 450MHz (RAID 5 CONFIGURATION)	NEW DELL POWEREDGE 4300 SERVER PENTIUM II PROCESSOR AT 450MHz (DUAL PROCESSOR/RAID CAPABLE)
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\$2449 Business Lease*: \$93/Mo., 36 Mos.  E-VALUE CODE: 04035-290124	\$3999 Business Lease*: \$151/Mo., 36 Mos.  E-VALUE CODE: 04035-290139	\$5499 Business Lease*: \$202/Mo., 36 Mos.  E-VALUE CODE: 04035-290154	\$5999 Business Lease*: \$220/Mo., 36 Mos.  E-VALUE CODE: 04035-290159

NEW DELL POWEREDGE 4300 SERVER DUAL PENTIUM II PROCESSORS AT 350MHz (DUAL PROCESSOR/RAID 5 CONFIGURATION)	DELL POWEREDGE 6300 SERVER PENTIUM II XEON™ PROCESSOR AT 400MHz (QUAD PROCESSOR CAPABLE)
• 128MB 100MHz ECC SDRAM • 512KB Integrated L2 ECC Cache • Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives • Ultra-2/LVD PowerEdge Expandable RAID Controller 2/SC • 32X Max* Variable SCSI CD-ROM Drive • HP OpenView NNM Special Edition • Intel Pro/100+ PCI Ethernet Adapter • Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers • Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans • 6 Expansion Slots: 4 PCI, 2 PCI/ISA • 10 Bays: 6 Drive Bays, 4 Media Bays • 3-Year NBD On-site* Service • 1-Year DirectLine NOS Support • 7x24 Dedicated Server Hardware Technical Telephone Support	• 128MB ECC EDO Memory • 512KB Integrated L2 Cache/Processor • Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives • Ultra-High Performance 64-bit Ultra-2/LVD PowerEdge Expandable RAID Controller 2 • 32X Max* Variable SCSI CD-ROM Drive • HP OpenView NNM Special Edition • Intel Pro/100+ PCI Ethernet Adapter • Integrated Dual Ultra-2/LVD and Ultra/Narrow SCSI Controllers • Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans • 7 Expansion Slots: 4x64-bit, 3x32-bit • 10 Bays: 6 Drive Bays, 4 Media Bays • 3-Year NBD On-site* Service • 1-Year DirectLine NOS Support • 7x24 Dedicated Server Hardware Technical Telephone Support
\$7449 Business Lease*: \$270/Mo., 36 Mos.  E-VALUE CODE: 04035-290174	\$11,899 Business Lease*: \$421/Mo., 36 Mos.  E-VALUE CODE: 04035-290101



DELL SERVER AWARD INFO¹¹

- *Network World* "World Class Award" for flexibility, serviceability and manageability – Dell PowerEdge 2300.
- *Computer Shopper* "Top 100" – Dell PowerEdge 2300.
- *PC Computing's* "The 'A' List" – Dell PowerEdge 6300.

Advertised configurations vary from award winning configurations

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- Sound Blaster Pro Compatible Sound
- 3Com® 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS® Windows NT® 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site⁴ Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support

\$5979

Business Lease⁶: \$220/Mo., 36 Mos.

 **E-VALUE CODE: 04036-490159**

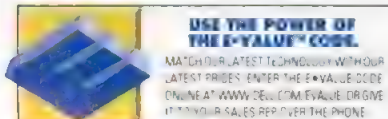
DELL PRECISION WORKSTATION 410 PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 Cache
- 4GB Ultra-2/LVD SCSI Hard Drive
- 17" (15.9" viewable) 1000LS Monitor
- Diamond 8MB AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- harman/kardon HK-195 Speakers
- 3Com 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS Windows NT 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site⁴ Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support

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- MSN® Internet Explorer®
- 3-Year NBD On-site¹ Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support

\$2199

Business Lease²: \$83/Mo., 36 Mos.

E-VALUE CODE: 31231-123122

2 BUILD THIS

CUSTOM CONFIGURE YOUR SYSTEM

2 component selections may require changes to other system options. Please check below.

Dell Dimension XPS R Mini Tower
Pentium® III processor, 4GB/10GB with 5.1/2x9, 2.7" drive

Memory
128MB SDRAM

Hard Drive
14 4GB Ultra ATA Hard Drive (7200 RPM)

Monitor
21" 19" 8" viewable 26cp Trinitron® 1500HS Monitor (add \$531)

Video Card
NEW 18MB STB nVidia TNT 3C AGP Graphics Card

DVD-ROM or CD-ROM Drive
4.8X DVD ROM Drive and Decoder Card

Please review the following regarding your Video selection:
Not available on the 4.8X DVD with Software Decoding

Please review the following regarding your DVD selection:

3 GO TO THIS



4 AND GET THIS

Latest price

Your Price* **\$2,169** Business Lease** **\$82/month***(36 mos.)

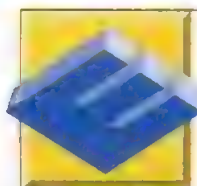
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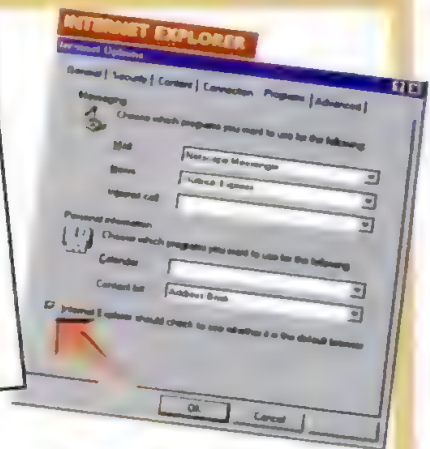
SOLVE APPLICATION CONFLICTS

Change Your Default Browser

The browser that comes up as your system's default can be a source of frustration, especially if you've switched sides at some point during the browser wars. Clicking on an HTML file in Windows Explorer, or sometimes even from links on a page you're already looking at, can open a browser other than you expect. Both Microsoft and Netscape browsers can each check to see which is the default browser and offer itself as the default. Both can also turn off this check, which presents a problem: if you want to change the default later on, how do you reenoble the check?



If you are using Netscape Communicator 4.x, make sure you exit Communicator and all its components. Go to your personal profile directory (typically, C:\Program Files\Netscape\Users\ProfileName). Open the file Prefs.js in Notepad and change `user_pref("browser.wife.ignore_def_check", true)` from "true" to "false." Save the file and exit the editor. The next time you load Communicator or any of its components, you will once again be asked whether you want to make it the default browser.



This is fairly simple in Internet Explorer. In IE3 or IE4, open Internet Options or Options (depending on the version you're using), located under the View menu (in IE5, Internet Options is under the Tools menu). On the Programs tab, click on the checkbox that says "Internet Explorer should check to see if it is the default browser." Now if IE is not the default browser, the program will ask you if you want to make it so.

No Uninstall Program

So you want to uninstall a program, and for some suspicious reason, the program has no uninstall program. Don't just delete that directory. Seriously consider a third-party uninstaller such as Symantec Corp.'s Norton CleanSweep, which will typically cost you between \$20 and \$40.

Uninstall Programs Properly

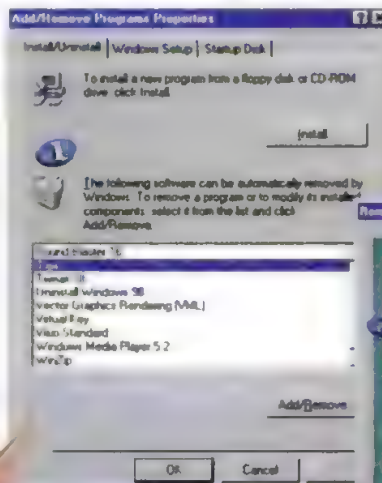
1 Many programs have their own uninstall option, typically accessible from the application's Start Menu group or the Add/Remove Programs applet in the Control Panel. This will usually get rid of the program.

2 When uninstalling, Windows does not usually delete user files, which include configuration files the program creates from your input. The main clue that these haven't been deleted is the message "Some elements could not be removed."

3 Once the uninstall is done, go into Explorer, look in the program's install directory for any files you would want to keep, and move or delete the directory. You may want to note where the program's directory is before you uninstall it by right-clicking on its shortcut and selecting Prop-

erties to see where the program is located.

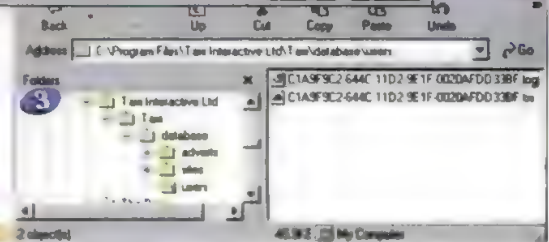
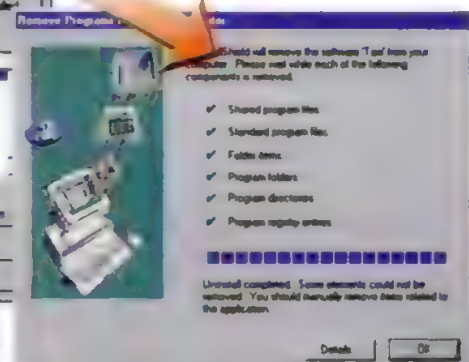
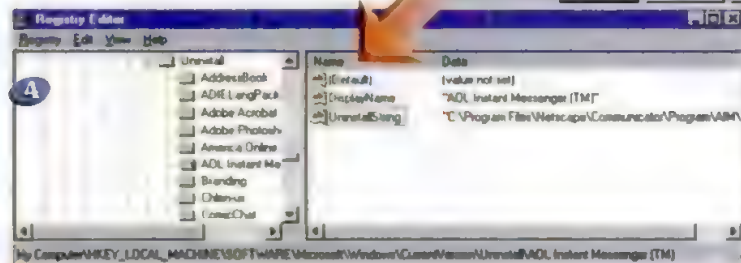
4 One common problem is that once the program is removed, its entry remains in the Add/Remove Programs list. To remove



the entry manually, you will need to edit your Registry.

Go to Start | Run and type Regedit. Go to the key Hkey_local_machine\Software\Microsoft\Windows\CurrentVersion\Uninstall. There you will see a series of keys, with one for each entry in the Add/Remove dialog box.

When you find the key with the values for the nonfunctioning entry, delete the entire key.



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James Senecal, LAN Specialist, Pacific Life Insurance, Newport Beach, CA.



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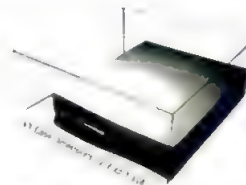
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- ▲ New Intel Pro 10/100 PCI Fast Ethernet Controller with RJ 45 and Wake-On-LAN Technology
- 32X Max Variable Speed CD-ROM Drive
- ESS Solo Wavetable Sound Card
- ▲ Quantex Slimline Case (12.9"x3.3"x14.2")
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- MS Windows 98
- ▲ QSentry Technology (including Intel Advanced Client Manager v3.1)

Quantex VX-400 \$1499

Order Code #pcm0274

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INTRODUCING!

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- 32X Max Variable Speed CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- ▲ Quantex Slimline Case (12.9"x3.3"x14.2")
- MS Natura Keyboard Elite with MS Mouse
- MS Windows 98
- ▲ QSentry Technology (including Intel Advanced Client Manager v3.1)
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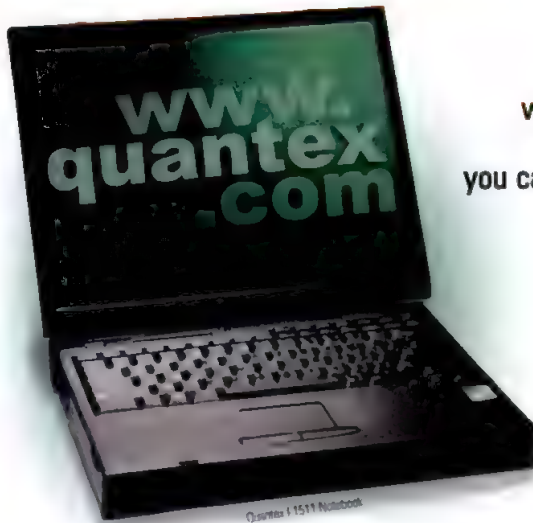
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WINLIST Award Windows Magazine (Oct. 98)

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Big On Screen. Small On Price. Quantex I-Series notebooks are now available with "XX-Large" 15" displays. Check them out starting at just \$2499.

I-SERIES NOTEBOOKS

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 - 4GB Ultra-ATA HD
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 - USB and Fast IR Ports / Integrated Personal Touchpad
 - MS Windows 98
 - Microsoft Office 97 SBE v2.0
 - Quantex Carrying Case
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 - 3-year limited warranty on CPU and Main Memory
 - 1 Year parts and labor warranty on all other components
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 - New ESS 3D Wavetable Surround Sound and Speakers
 - New Long-Lasting 12-Cell Smart Lithium Ion Battery
 - USB and Fast IR Ports / Integrated Personal Touchpad
 - MS Windows 98
 - Microsoft Office 97 SBE v2.0
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 - Year 2000 Compliant
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 - New ESS 3D Wavetable Surround Sound and Speakers
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 - USB and Fast IR Ports / Integrated Personal Touchpad
 - MS Windows 98
 - Microsoft Office 97 SBE v2.0
 - Quantex Carrying Case
 - Year 2000 Compliant
 - 3-year limited warranty on CPU and Main Memory
 - 1 Year parts and labor warranty on all other components
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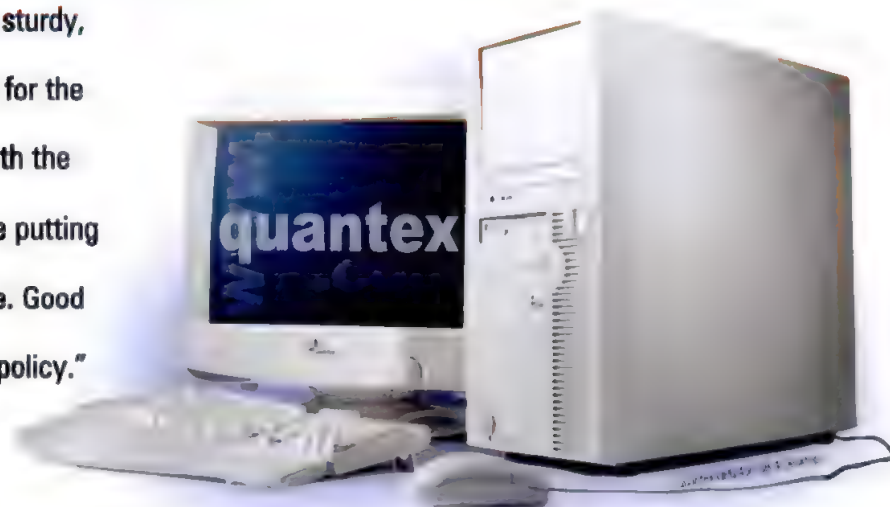
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- New Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- 32X Max Variable Speed CD-ROM Drive
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- Quantex ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows NT Workstation 4.0 / Microsoft Office 97 SE v2.0
- 3-year limited warranty with 1-year On-Site Service*
- 24-hr/7-day Technical Support
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- Business lease: \$53/Mo. Order Code #pcm0208**
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 - Toshiba MPACT2 3D/DVD Media Accelerator w/8MB SDRAM
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Aitec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98 / Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - Year 2000 Compliant
 - Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79
 - Optional Internal Zip Drive w/one cartridge, add \$79
 - Optional Aitec Lansing ACS-251 Subwoofer, add \$39

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 - 17" Digital Monitor w/OSD (15.8" viewable)
 - Toshiba MPACT2 3D/DVD Media Accelerator w/8MB SDRAM
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Aitec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98
 - Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - Year 2000 Compliant
 - Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79

QP6/350 M-3x(with Pentium II processor).....\$1449
QP6/450 M-3x(with Pentium II processor).....\$1799

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 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Aitec-Lansing ACS-90 Speakers
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 - Optional Aitec Lansing ACS-251 Subwoofer, add \$39

QP6/400 Best Buy(with Pentium II processor).....\$1849

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- Pentium® II Processor 350MHz
 - 64MB PC100 SDRAM Memory / 512KB Secondary Cache
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 - Intel740™ 3D 2X AGP Graphics with 8MB SDRAM
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - 32X Max Variable Speed CD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Aitec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
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 - MS Windows 98
 - Power Multimedia Software Bundle
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 - Year 2000 Compliant
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 - Upgrade to 3rd-Gen. 4.8X DVD-ROM Drive, add \$79
 - Upgrade to Aitec Lansing ACS-45.1 PowerCube Speakers with Subwoofer, add \$49
 - Optional Internal Zip Drive w/one cartridge, add \$79

QP6/400 SM-2x \$1799

- Business lease: \$63/Mo. Order Code #pcm0221**
- Pentium® II Processor 400MHz
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 - 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
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 - MS Windows 98 / Power Multimedia Software Bundle
 - Microsoft Office 97 SBE v2.0
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 - Year 2000 Compliant
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QP6/350 SM-2x(with Pentium II processor).....\$1649

QP6/400 SM-3x \$1999

- Business lease: \$70/Mo. Order Code #pcm0222**
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 - 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
 - New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
 - Based on award-Winning Voodoo2 3D Technology
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Aitec-Lansing ACS-45.1 PowerCube Speakers w/subwoofer
 - Quantex ATX Mid Tower Case
 - MS Natural Keyboard Elite with MS IntelliMouse
 - MS Windows 98 / Power Multimedia Software Bundle
 - Microsoft Office 97 SBE v2.0
 - 3-year limited warranty with 1-year On-Site Service**
 - Year 2000 Compliant
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QP6/450 SM-3x(with Pentium II processor).....\$2199

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 - New 19" Monitor w/NEC ChromaClear CRT (18.1" viewable), 1600x1200, 25dp
 - New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
 - Based on award-Winning Voodoo2 3D Technology
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
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 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
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 - Quantex ATX Mid Tower Case
 - MS Natural Keyboard Elite with MS IntelliMouse
 - MS Windows 98 / Power Multimedia Software Bundle
 - Microsoft Office 97 SBE v2.0
 - 3-year limited warranty with 1-year On-Site Service**
 - Year 2000 Compliant
 - Upgrade to Ultra-Fast #9 Revolution IV 128-bit 3D AGP video w/32MB, add \$49

SUPER MULTIMEDIA

QP6/450 M-4x SE \$2199

- Business lease: \$77/Mo. Order Code #pcm0209**
- Pentium® II Processor 450MHz
 - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
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 - New 19" Monitor w/NEC ChromaClear CRT (18.1" viewable), 1600x1200, 25dp
 - Intel740™ 3D 2X AGP Graphics with 8MB SDRAM
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Aitec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98
 - Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - Year 2000 Compliant
 - Optional Aitec Lansing ACS-251 Subwoofer, add \$39

QP6/400 M-4xSE(with Pentium II processor).....\$1999

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- Business lease: \$101/Mo. Order Code #pcm0224**
- Pentium® II Processor 450MHz
 - 256MB PC100 SDRAM Memory / 512KB Secondary Cache
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 - Based on award-Winning Voodoo2 3D Technology
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - New Aitec-Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers with subwoofer
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 - Action Game Titles: Battlezone, Heavy Gear Interstate 76 w/Nitro Pack
 - 3-year limited warranty with 1-year On-Site Service**
 - Year 2000 Compliant
 - Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79

QP6/450 GX-2 \$2399

- Business lease: \$84/Mo. Order Code #pcm0242**
- Pentium® II Processor 450MHz
 - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
 - 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
 - Intel740™ 3D 2X AGP Graphics with 8MB SDRAM
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - Aureal "A3D" 3D Positional PCI Sound
 - New Dual 3Dfx Voodoo2 SLI 3D Game Accelerator w/24MB (2X more powerful than single Voodoo2 accelerator)
 - MS SideWinder Precision Pro Joystick
 - New Aitec-Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers & subwoofer
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98 / Value Multimedia Software Bundle
 - Action Game Titles: Battlezone, Heavy Gear Interstate 76 w/Nitro Pack
 - Year 2000 Compliant



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PREVENT HARDWARE CONFLICTS

When a Device in the Computer Isn't Working

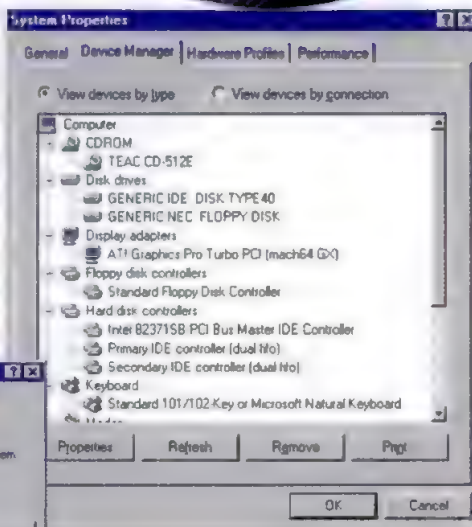
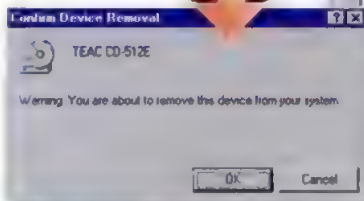
Sometimes a device, such as a scanner or network card, mysteriously stops working under Windows. If you can't find an easy solution (loose cord, power off, or the like), write down its properties such as the IP and DNS addresses on a network card and make sure you have the latest drivers handy either on disk or downloaded from the company's Web site. Then follow these instructions to delete the device from the Windows Device Manager and let Windows set the device up again.



1 Open the System applet in Control Panel and select the Device Manager tab. Here, you will see a list of the devices in your system.

2 Find the device in question, click on it, and then press the Remove button. You may also see the effect of a common Windows bug in the form of two or more entries for one device. In this case, remove all the entries.

3 After you have removed the device, shut Windows down and restart.



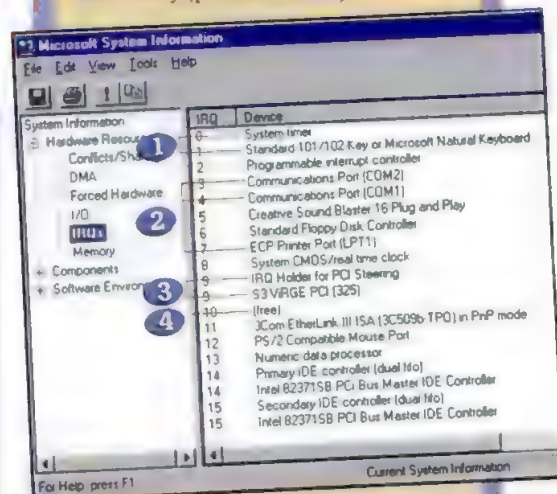
IF IT WORKS Windows will probably detect and reinstall the device. Because Windows analyzes the system at times like this for available resources, it will often reassign your device to different resources than it had before, and any problems should go away.

IF IT DOESN'T In some cases, Windows will prompt you to insert the device's Installation disk. If it doesn't find your device, you may have to run the installation routine again.

Diagnose Hardware Conflicts

IRQ (Interrupt ReQuest) lines are like dedicated phone lines that ring up the CPU for attention, just as phone calls interrupt you. Sixteen IRQs (0-15) are addressable.

You can view IRQ assignments under Windows in several ways. One method that Windows 95 and 98 have in common is under Control Panel's System option and the Device Manager tab. Double-click on Computer at the top of the tree. In Windows 98, you can view IRQs through the System Information Utility (pictured below).



1 Several IRQs are already dedicated to system devices (such as system timer, disk drives, and the keyboard) and cannot be used.

2 Certain IRQs have been commonly used for the standard I/O ports—serial and parallel—usually IRQ 4, 3, and 7, representing COM1, COM2, and LPT1, respectively. The IRQs that are left can be used to add new hardware.

3 The PCI bus in most new systems permits interrupt allocation flexibility during boot-up. Replacing your non-plug-and-play ISA cards with PCI cards can be a great boon to the IRQ-challenged.

4 Installing plug-and-play hardware can reduce IRQ conflicts. At boot-up, Windows scans for available IRQs and will assign them to hardware drivers on the fly. Buy USB peripherals in the future. This should let you free up a COM or LPT port that's currently occupying an IRQ.

Boot Shortcuts

For some kinds of troubleshooting, you need to boot your PC into a mode other than the normal Start-up.

If you're a Windows 95 user, start your machine and press the F8 key when you see the Starting Windows message.

With Windows 98, you'll need to hold down the Ctrl key when the computer beeps

after the Power-On Self Test until the menu comes up.

The menu gives you selections for:

1. Normal.
2. Logged (Bootlog.txt).
3. Safe mode.
4. Safe mode with network support (if you're connected to a network).
5. Step-by-step confirmation.
6. Command prompt only.
7. Safe mode command

prompt only.

8. Previous version of MS-DOS (Windows 95 only).

If you're a Windows 98 user, you have 30 seconds to select a boot mode once the menu pops up. Windows 95 doesn't time you out, so users have to select something. The default will be highlighted (usually it's Safe Mode) and will boot if you don't select another option.



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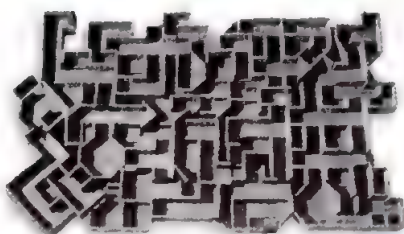


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PC Magazine Choose 106 at www.pcmag.com/infolink

IMPROVE INTERNET CONNECTIONS

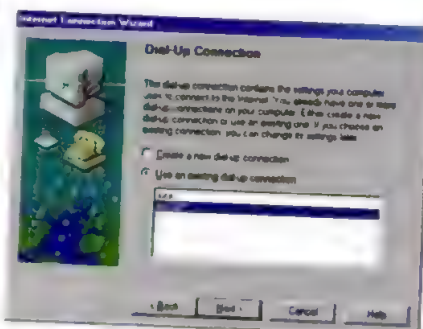
Connect to the Internet as Needed

If you connect to the Internet via a modem, wouldn't it be nice if your modem dialed up and connected to your ISP every time you launched your browser, mail client, and so on? Going through IE, you can set up any Winsock application—Eudora, Netscape Navigator, or WS_FTP, among others—to dial automatically once you launch one of these applications.

The easiest way is to run the Internet Connection Wizard. If you have IE3, go to the Start Menu and select Programs | Accessories | Internet Tools | Get on the Internet. If you have Windows 98, go to Start | Programs | Accessories | Internet

Tools | Connection Wizard.

This tip gives you the added benefit of a prompt to disconnect when you close your browser or other Internet application.



Get Dial-Up Networking to Remember Your Password

Sometimes, no matter how many times you check the Save Password box, Dial-Up Networking (DUN) just won't do it. This is a fairly common problem.

Two quick tips will fix most instances of this problem. First, you must be logged on for Windows to remember passwords. That means don't hit Esc when Windows asks you to log on. If you don't want to type a Windows log-on password each time, leave your password blank under the Passwords Control Panel applet.

Second, DUN will not remember a password unless you've made a successful connection to the server.

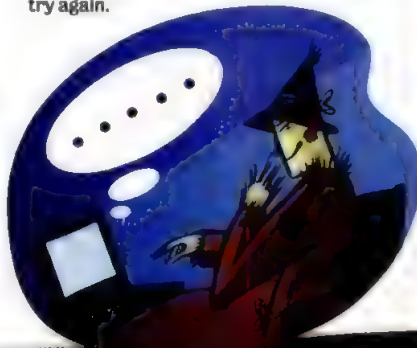
If these approaches don't work, the next step is to remove and reinstall DUN. First, download the most recent version of DUN before you disable the present one. You'll find it at support.microsoft.com/support/downloads/dp3267.asp?FR=0 if you're a Windows 95 user and support.microsoft.com/

[support/downloads/dp3268](http://support.microsoft.com/support/downloads/dp3268.asp?FR=0)

[.asp?FR=0](http://support.microsoft.com/support/downloads/dp3267.asp?FR=0) if you're a Windows 98 user.

Open the Add/Remove Programs applet in the Control Panel. Select the Windows Setup tab. Click Communications, then Details. Click on the Dial-Up Networking checkbox once to clear it, click OK, and then restart your computer when you are prompted to do so.

After the reboot, install the new DUN and try again.



Control Panel Shortcuts

Clicking around the desktop will get you to the applets you use most.

Applet

System

Network

Date/time

Display

Internet

Mail

PC Card services

Power management

Printers

Where to click

Right-click on My Computer.

Right-click on Network Neighborhood.

Right-click on the clock in the tray.

Right-click on any open area of the desktop.

Go to View | Internet Options in Internet Explorer.

Go to Tools | Services in Outlook or Outlook Express.

Right-click on the PC Card icon in the tray.

Right-click on the battery icon in the tray.

Go to Start | Settings | Printers

Find Your IP Settings

Finding your network setting through Windows can be a challenge. The best way to do it is to go to Start | Run and type in `windowsipcfg`

This undocumented program will give you all the info you need if you're having a network problem or not connecting correctly to your ISP. Click on the More Info button to get a complete IP profile.

Connect to the Web at Start-Up

Is Web surfing your primary computing activity? If you want to have your computer dial the Internet each time you start up, here's how:

1 You'll need a fairly new version of Dial-Up Networking. To get the latest DUN for Windows 95, go to <http://support.microsoft.com/support/downloads/dp3267.asp?FR=0>. If you're using Windows 98, you're fine.

2 Once you're up and running, right-click on the Start button and choose Explore. Click on the + to the left of the Programs folder to expose its subfolders, including StartUp.

3 Now scroll the left pane down below your drives until you find the Dial-Up Networking entry on the left. Click on it and you should see your Dial-Up Networking entries to the right.

4 Select the connection you want to use each time you start up and then click on the Connection menu and choose Settings. Uncheck the box that says "Prompt for information before dialing."

5 Scroll the left pane back up to the point where you can again see the StartUp folder, then drag a copy of the Dial-Up Networking connection to it.

6 Reboot your system; you'll be on the Web in no time.

7 If you're going online every time, you're probably going to the Web and checking e-mail. Put shortcuts to your favorite browser and mail client in C:\Windows\StartUp as well.

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PRINT WITHOUT PAIN

Getting Started

Microsoft Windows has built-in help for you related to many difficulties that may arise from printing. You can find the Printers.txt file in the Windows folder, and it's full of useful information that may help you diagnose common printing problems.

You can also try the Print Troubleshooter to help you out. In Windows 95, go to Start | Help. On the Contents tab, double-click on the Troubleshooting topic. Double-click on the If You Have

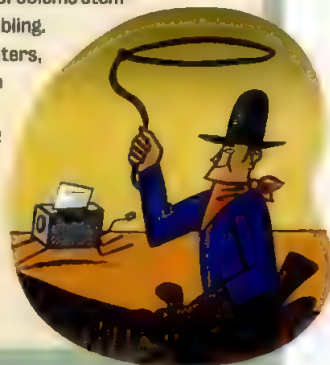
Trouble Printing topic.

You will also find the Windows 95 Resource Kit includes a more detailed Print Troubleshooter tool. It's also available on the Windows 95 Upgrade CD-ROM in Other\Misc\Epts\Epts.exe.

Windows 98 users will see the Print Troubleshooter under Trouble-shooting in the Help menu. Click on Windows 98 Troubleshooters, and then click on Print.

Keeping Your Printer Close

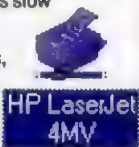
Some printer problems stem from poor cabling. For personal printers, you should use an IEEE-1284-compliant cable—and use a short cable for better performance. A 6-foot or shorter cord should be safe.



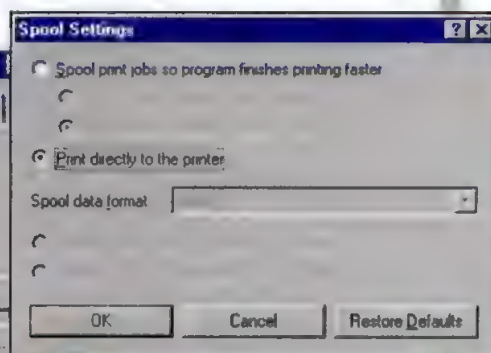
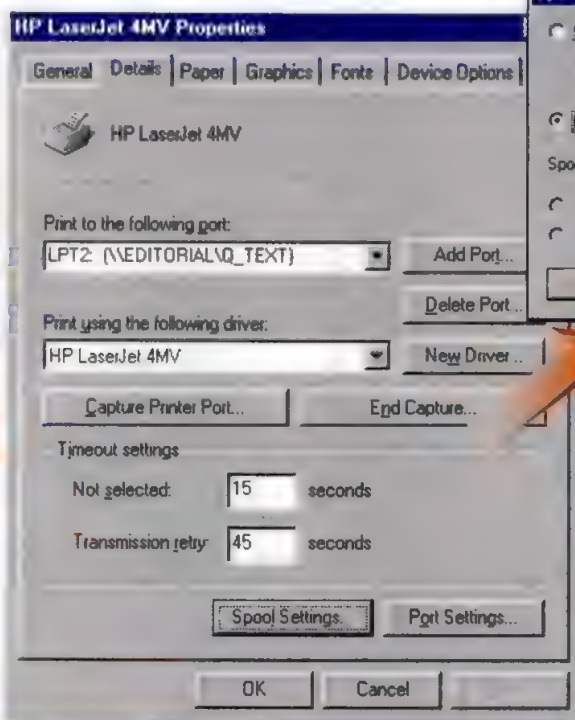
Improve Your Printing Speed

Windows defaults to spooling print jobs. The Print Spooler is a background program that writes data to temporary files in your C:\Windows\Temp directory. Although this lets you perform other tasks while you print, it does slow printing.

1 On most printers, you can turn off the spooler by going to Start | Settings | Printers. Right-click on the icon of the printer you're using.



2 Click Properties and select the Details tab. Click on the Spool Settings button at the bottom of the dialog box.



3 Select the Print Directly to Printer option. This will tie up your application until the printer has all the data, but your print job should finish more quickly. Printing directly to the printer will also come in handy if your print spooler crashes and you need to print before you reboot your PC.

Windows Hotkeys

So what does that Windows key do anyway?

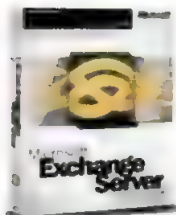
Win	Opens the Start menu.
Win+E	Starts Explorer.
Win+F	Finds files or folders.
Ctrl+Win+F	Finds computer.
Win+M	Minimizes all windows.
Shift+Win+M	Restores minimized windows.
Win+R	Displays Run dialog box.
Win+Tab	Cycles through taskbar buttons.
Win+Break	Displays system properties.

When Printing Problems Occur in Only One Application

- Try printing from Notepad or WordPad to make sure that the problem is limited to just one application and isn't indicative of a problem with Windows.
- If the problem occurs in one document only, try to print a blank page inside the application. If this prints, the application may have problems with memory or fonts.
- If you're using a 16-bit application, the problem could be an INI file that needs to be modified to accommodate the application. You should reinstall the application and contact the manufacturer of the application for specific settings that might affect printing.

OUR CONTRIBUTORS: LARRY SELTZER is a frequent contributor to PC Magazine. BEN Z. GOTTESMAN is a technical director at PC Magazine Labs. JAY MUNRO was the senior project leader, and DAVID LIDSKY was the associate editor in charge of this story.

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¹ Source: Data during this time frame: Jan. 1-June 30, 1998. EMMS: Sept. 4, 1998. ² Source: The Radical Group, July 1998.

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SOFTWARE to GO

After years of missteps, hand-held computing is coming into its own with a multitude of applications that extend the functionality of your Palm or Windows CE device.

By Marge Brown

Not long ago, hand-held computers offered only rudimentary applications that were preinstalled. But that situation began to change when U.S. Robotics introduced the Pilot (running Palm OS) . It was an overnight success. Soon after, Microsoft released the Windows CE operating system . Though it received a lukewarm reception, Windows CE has gained momentum as it has branched out into everything from mini-notebooks to car stereos.

Meanwhile, the software options for these devices are expanding. Here, we've surveyed 33 applications from a range of categories including productivity, communications, utilities, data entry, mapping, and entertainment. But these are just a sample of the many programs out there that will help you get the most out of your PC companion.

To install software on a hand-held device, you must first install it on your desktop PC. Windows CE Services automatically detects the new application. With a Palm OS device, the Palm Desktop software includes an Install utility for selecting files to load. In our tests, both Windows CE Services and Palm Install worked flawlessly.

Still can't get enough of software for your Palm organizer? Check out ZDNet's PalmPilot Software Library for more reviews and downloads, plus the winners of the First Annual PalmPilot Shareware Awards (www.zdnet.com/swlib/pilotsoftware/awards/awards.html), sponsored by PC Magazine and ZDNet.



Our Contributors: MARGE BROWN is a freelance writer. MATTHEW GRAVEN is a staff editor of *PC Magazine*. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

PRODUCTIVITY

Actioneer 2.0 for Palm OS



PALM

\$19.95 direct

Memory requirements: 120K

The intelligent approach to information management, Actioneer for Palm OS 2.0 parses notes you enter using Graffiti and automatically inserts them in the appropriate places in the Date Book, To Do List, and Memo Pad. When we entered the phrase *Call Bruce tomorrow*, Actioneer automatically added it to the To Do List with the correct due date and inserted it in the Date Book on the appropriate day. Actioneer distributes items based on default and custom keywords. You can also use Actioneer in conjunction with the more powerful \$39.95 desktop version, Actioneer Palm Desktop 1.0. (Actioneer Inc., San Francisco; 800-942-4044; www.actioneer.com.)

The Portable PIM

Though you've joined the hand-held revolution, you don't have to ditch your PIM or contact manager. Many applications now include conduits for palm-size PCs (P/PCs), hand-held PCs (H/PCs), and Palm organizers. —Matthew Graven

ACT!

Take data with you from Symantec's popular contact manager ACT! for Windows 4.0 using these links for Palm and Windows CE-based hand-held devices.

ACT! for Windows CE Version 1.01 (\$100 street); ACT! PalmPilot Link (free); Symantec Corp. Cupertino, CA, 800-441-7234, 408-253-9600, www.symantec.com

ASCEND 97

This desktop PIM includes links for all Palm connected organizers and comes from the people who brought us the Franklin Day Planner and The Seven Habits of Highly Effective People.

Ascend 97 Version 6.1c (\$100 street); Franklin Covey Co., Salt Lake City, 800-877-1814, 801-975-1776, www.franklincovey.com

LOTUS ORGANIZER

Well known for its appealing interface, Lotus Organizer also includes an EasySync feature for linking with Palm organizers.

Lotus Organizer 5.0 (\$80 street); Lotus Development Corp. Cambridge, MA, 800-346-1305, 201-948-2338; www.lotus.com

MAXIMIZER

Whichever hand-held platform you use, you can stay in sync with all recent versions of Maximizer (3.0is, 97, and 5.0) and Maximizer Enterprise (4.0 and 5.0). Maximizer for Palm-size PCs 5.0 (\$70 street); Maximizer for Handheld PCs 5.0 (\$70 street); Maximizer Link for the Palm Computing Platform 5.0 (\$50 street); Multiactive Software Inc. Vancouver B.C. Canada 800-804-6299, 604-601-8000, www.maximizer.com

POCKET ON-SCHEDULE

This Windows CE-based application offers the features of a desktop contact manager and synchronizes with Microsoft Schedule+ and Outlook. Pocket On-Schedule 2.5 (\$90 direct); Odyssey Computing Inc., San Diego, 800-965-7224, 619-675-3660, www.odysseyinc.com

bReady 2.0

H/PC

P/PC

\$49.95 direct

Memory requirements: 500K

Turn your P/PC or H/PC into a portable publishing platform with Bsquare's bReady 2.0. Using bReady's desktop PC Publisher component, you can group text documents, HTML files, Web pages, and graphics files into books. You decide on the chapter and page organization, keyword index, annotations, and bookmarks. Once a book is transferred to your mobile device, you can view it, annotate it, set bookmarks, and perform text searches. In our tests, we found this application to be a great solution for any documents that you need to refer to on a regular basis. (Bsquare Corp., Bellevue, WA; 888-820-4500; www.bsquare.com.)

HPC Notes 2.02

H/PC

P/PC

\$60.00 street

Memory requirements: 290K

By working with existing desktop and hand-held note-taking applets, PhatWare's HPC Notes 2.02 broadens the capabilities of Windows CE devices. It can synchronize notes with Microsoft Outlook 97 or 98, import and export notes, and exchange notes with Palm Desktop. Other features include a spell-checker, password protection, and the ability to download, search and sort notes based on type, subject and date. Service Pack 1 improves synchronization and adds several new features. (PhatWare Corp., Redwood City, CA; 650-299-0110; www.phatware.com.)

JFile 3.0f

PALM

\$20.00 street

Memory requirements: 60K

Land-J Technologies' Jfile 3.0f can store as many as 30 databases with unlimited records on your Palm organizer. You can develop your own databases, convert comma-separated text files on your PC to Jfile's PDB format, or download existing databases from a variety of sources. Jfile supports database-level passwords, seven field types, and in-place field editing. You can even include Jfile databases in your Palm device's Find function. (Land-J Technologies, Orlando, FL; 407-382-8348; www.land-j.com.)

Pocket BizCalc 4.0

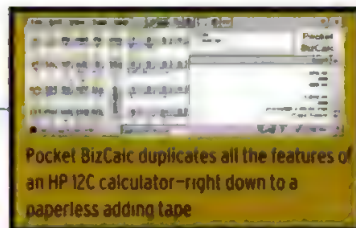
H/PC

P/PC

\$40.00 direct

Memory requirements: 300 to 320K

Employing Reverse Polish Notation, Odyssey Computing's Pocket BizCalc 4.0 simulates the revered HP 12C calculator. Ideal for financial, actuarial, and statistical functions. Pocket BizCalc offers templates for calculating 120 business functions and 20 cash-flow analyses. And the programming feature lets you automate repetitive calculations that can consist of as many as 999 individual steps. (Odyssey Computing Inc., San Diego; 800-965-7224; www.odysseyinc.com.)



Pocket Finance 2.0

H/PC

P/PC

\$40.00 street

Memory requirements: 50K

LandWare's Pocket Finance 2.0 helps you manage finances with your Windows CE device. Using the included Pocket Finance Administrator for the desktop, you exchange and synchronize files between your mobile and desktop computers. Pocket Finance stores ATM transactions, deposits, withdrawals, transfers, and checks, and the program handles split transactions and categories with ease. Pocket Finance is compatible with both Intuit's Quicken and Microsoft Money. (LandWare, Oradell, NJ; 800-526-3977; www.landware.com.)



CONTACT WIRELESS HANDHELD PC:
The Wireless Handheld PC keeps you in touch at the time with a wireless PDA. It can be used with a mobile phone, or even the Web, and can applications such as a calendar, to-do list, and more. Price: \$1,995 direct. Contact: Wireless Handheld PC, Inc., 100-10000, www.wirelesspc.com

Spyglass Mobile Forms Database 2.0

PALM

\$80.00
street

Memory
requirements:
320K

Spyglass Mobile Forms Database 2.0 lets you create customized databases. You define each database field by type, and indicate whether it is a sort key or is to be included in list view. Once your data is collected, you can sort it, perform searches, and view it by list or single record. Delimited text files can be exchanged between your desktop PC and H/PC. However, you can't export partial records, there's no way to search across all fields, and the program lacks a print function. (Spyglass Inc., Naperville, IL; 800-526-3977; www.spyglass.com.)

VehicleLog 1.0

PALM

\$20.00
street

Memory
requirements:
35K

If you have to itemize vehicle expenses, Little Wing Software Development's VehicleLog 1.0 can be a lifesaver. It can track fuel purchases, mileage, and maintenance costs for up to seven vehicles. In addition, VehicleLog can calculate fuel economy and remind you when it's time for servicing. You can even export data to word processors or spreadsheets to create reports for resale, taxes, or expense reimbursements. (Little Wing Software Development, San Antonio; 800-741-9070; www.lwsd.com.)

COMMUNICATION

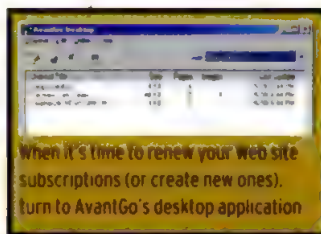
AvantGo 1.1

PALM

\$0.00
free

Memory
requirements:
98K

The PointCast of the Palm world, AvantGo 1.1 consists of AvantGo Desktop and AvantGo Client. Using AvantGo Desktop, you subscribe to channels or Web sites, which the program downloads. Via HotSync, AvantGo Desktop transfers the pages with or without graphics to your Palm organizer, where you can view them with AvantGo Client. The enterprise version, AvantGo 2.0 (\$30,000 direct for 100 users), offers synchronization with a corporate server and centralized administration. (AvantGo Inc., San Mateo, CA; 888-884-8812; www.avantgo.com.)



When it's time to renew your Web site subscriptions (or create new ones), turn to AvantGo's desktop application

bFax Pro 4.0

H/PC

\$69.95
direct

Memory
requirements:
830K to 1MB

If you ever need to send or receive faxes while on the go, bFax Pro 4.0 is just what you're looking for. Along with a compatible modem, bFax enables your device to send and receive faxes. You can fax 2-, 4-, or 8-bit images, plain text, Microsoft Pocket Word documents and templates, and Casio Camera files. Received faxes are stored as TIFF files. The included Print-to-bFax feature lets you queue faxes for batch transmission. (Bsquare Corp., Bellevue, WA; 888-820-4500; www.bsquare.com.)

PC EDITORS' HOT LINKS

www.pcmag.com

The Web is an excellent resource for hand-held users. Here are some of our top picks.

► **ZDNET's PalmPilot Shareware Awards**
<http://www.zdnet.com/swlib/pilotsoftware/awards/awards.html>
Check out the winners of the First Annual PalmPilot Shareware Awards.

► **Microsoft Windows CE**
www.microsoft.com/windowsce/default.asp
Microsoft's Windows CE site describes the various versions of Windows CE and the hardware platforms they run on.

► **MobilePlanet Inc.**
www.mobileplanet.com
An online store devoted entirely to road warriors, MobilePlanet is packed with software and accessories.

► **PalmPilotGear H.Q.**
www.pilotgear.com

One of the best-known destinations for Palm people, PalmPilotGear H.Q. offers an extensive selection of software and accessories.

► **3COM's Palm Computing Division**
www.palm.com
Get news, support, software, and accessories for your Palm organizer straight from the source.

► **TUCOWS Interactive Ltd.**
www.tucows.com
The popular TUCOWS online software store includes the PDACentral section, which offers a huge selection of software titles.



HandMail 2.0 and HandWeb 2.0

PALM

\$50.00
street (each)

Memory
requirements:
**HandWeb, 162K;
HandMail, 173K**

HandMail 2.0 and HandWeb 2.0 are useful products for accessing e-mail and the Web from a Palm organizer. HandMail lets you connect to America Online or an Internet service provider to check any standard POP3 e-mail account. You can send and receive messages with attachments and download messages selectively for five accounts. HandWeb lets your PalmPilot connect to your ISP and browse the Web. You can browse with or without graphics and store pages for off-line viewing. (Smartcode Software Inc., San Diego; 888-860-2180; www.smartcodesoft.com.)

One-Touch Communicator 1.0

PALM

\$49.95
direct

Memory
requirements:
191K

You'll never be out of touch with One-Touch Communicator 1.0 and your Palm organizer. One-Touch Communicator lets you manage six standard POP3 e-mail accounts, and it works with many common e-mail systems, including Microsoft Outlook—but not America Online. All the wished-for e-mail features are here, including the ability to send and receive messages up to 60K with attachments, folder organization, message filtering, address book linking, a reusable 250-character signature, and password-protection. One-Touch Mail 1.0 (\$49.95 direct) offers IMAP4 support, more wireless features, and compatibility with Lotus Notes. (JP Systems Inc., Dallas; 888-665-2460; www.jpssystems.com.)

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- NEW** Extensive command and control to format and edit
documents in Microsoft® Office, including Word 97/95,
Excel 97, PowerPoint® 97, Outlook® 98, and Outlook®
Express. And, it's optimized for Windows® 98.
- NEW** Four FREE special plug-in vocabularies for Business
& Finance, Leisure, Technology, and In The News.
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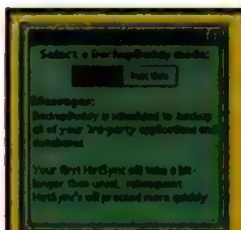
L&H
Lernout & Hauspie™
www.lhs.com

pcAnywhere CE 1.0

H/PC

\$79.95
directMemory
requirements:
200K
system,
600K
program

The Windows CE version of Symantec's remote-control application puts you in the driver's seat. With pcAnywhere CE 1.0, a server administrator, for example, can connect to a server that is running the included pcAnywhere Host and take control of it. pcAnywhere CE is not for novices but system administrators and road warriors will appreciate its power. (Symantec Corp., Cupertino, CA; 800-441-2234; www.symantec.com.)



You can protect all of your data by using BackupBuddy to back up everything on your Palm Organizer.

UTILITIES

BackupBuddy 3.05



PALM

\$15.00
streetMemory
requirements:
19K

BackupBuddy 3.05 is an extremely functional yet easy-to-use utility. BackupBuddy backs up everything in your Palm device so you can easily restore the data if necessary. You can set it for either QuickSync, which performs incremental backups, or TimeSync, which lets you schedule BackupBuddy to initiate a HotSync on a regular basis. (Intelligent Systems, distributed by PalmPilot Gear H.Q., Arlington, TX; 800-741-9070; www.palmpilotgear.com.)

bPrint 2.0

H/PC

P/PC

\$29.95
directMemory
requirements:
965K to
1MB

A robust printer utility, bPrint lets you print text, rich-text format, bitmap, and TIFF files from a Windows CE device. To fine-tune your output, you can adjust formatting options, including margins and fonts. Prior to printing, you can view your documents at four different zoom levels using the included bSquare View. You can queue print jobs to wait until you connect to a printer, and bPrint can send print jobs via a serial cable or infrared connection. (Bsquare Corp., Bellevue, WA; 888-820-4500; www.bsquare.com.)

Image Expert CE 1.0

H/PC

\$49.95
directMemory
requirements:
500K to
1.5MB

Designed for mobile professionals who use digital cameras, Image Expert CE 1.0 lets you view, store, annotate, present, and transfer digital images. Image Expert lets you import color BMP or JPEG images from a computer or supported cameras via a serial cable, CompactFlash card, or SmartMedia with a PC Card adapter. You can create annotations that remain on a separate layer, and produce slide show presentations. You can even e-mail or beam (via IrDA) image files to another H/PC. (Sierra Imaging Inc., Scotts Valley, CA; 887-446-2439; www.sierraimaging.com.)



JETTALKER
The Jettalker Jettalker adds support for voice input to PalmPilot. Adding a microphone and memory for storing messages, it lets you dictate and edit up to 34 minutes of notes. Street price: \$149. Direct Price: \$149-159. www.dynalife.com.

QuickNotes Pro 1.0

PALM

H/PC

P/PC

\$39.00
directMemory
requirements:
500K to
600K

QuickNotes Pro 1.0 helps you keep track of notes, drawings, and signatures. With QuickNotes Pro, you enter notes into your mobile unit with the keyboard or stylus. Each note page can be time- and date-stamped, and it can be custom-stamped for its type of event, class, and status. QuickNotes Pro supports 256 colors for text and screen backgrounds. You can cut, paste, and search notes, and you can print, fax, and e-mail note pages in full letter size as well. The included desktop companion QuickNotes Pro is valuable for archiving, downloading, and viewing notes on your PC. (Communication Intelligence Corp., Redwood Shores, CA; 800-888-8242; www.cic.com.)

DATA ENTRY

ARTRecognition 1.0

P/PC

\$59.95
directMemory
requirements:
650K

ARTRecognition 1.0 includes smARTwriter for handwriting recognition and Pocket Commander for voice recognition. A flexible handwriting-recognition application available in six languages, smARTwriter can be trained to recognize handwriting in any style, but you still have to lift the stylus between characters. Its macros launch other applications or insert text strings. Once you train Pocket Commander to recognize your voice commands (there are 18 standard ones plus unlimited user-defined commands), the software will launch applications, open files, automatically dial telephone numbers, set up e-mail templates, and create other valuable shortcuts. (Advanced Recognition Technologies Inc., Simi Valley, CA; 888-762-7845; www.artcomp.com.)

CalliGrapher 5.2

H/PC

P/PC

\$49.95
directMemory
requirements:
700K to
1MB

There's an almost magical quality to the way CalliGrapher 5.2 adroitly deciphers natural handwriting. Despite a hefty footprint, it provides fast and accurate handwriting recognition with cursive, printed, and mixed input styles, and has a customizable 65,000-word dictionary. CalliGrapher needs no training, but you can identify your preferences in the Letter Shape Selector for faster and more accurate conversion of your input to printed text. (ParaGraph, a division of Vadem, San Jose, CA; 408-467-7740; www.paragraph.com.)

Jot Pro 1.0

P/PC

\$29.00
directMemory
requirements:
155K

An upgrade to the handwriting recognition tool Jot, which is standard on P/PCs, Jot Pro 1.0 is a lightweight option for noncursive writers who do not mind conforming their input styles to Jot Pro's character set. Because you can use the entire screen for input, Jot Pro effectively transforms your P/PC into a miniature writing tablet. Small pointers demarcate an imaginary line dividing the full screen either horizontally or vertically, for entering lowercase letters, uppercase letters, and numbers in separate areas of the screen. (Communication Intelligence Corp., Redwood Shores, CA; 800-888-8242; www.cic.com.)



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T9 Text Input 1.0

PALM

\$29.95
direct

 Memory
requirements:
177K

A fast, intuitive alternative to Palm's Graffiti, T9 Text Input 1.0 uses a telephone-like keypad with several letters for data entry. The program matches your keystrokes with words in its linguistic database to form the intended words and punctuation. On our tests T9 seemed remarkably fast, and we had great fun watching it go through its paces. If its conversion fails, you can either select words from a list or key them letter by letter. You can use T9 interchangeably with Graffiti and QWERTY keyboards. (Tegic Communications Inc., Seattle; 888-834-4289; www.tegic.com.)

MAPPING

Palm Navigator 1.0

PALM

\$39.95
direct

 Memory
requirements:
50K

You'll always know which way is up with the Palm Navigator 1.0. Using a 2.4-ounce electronic compass, the Palm Navigator provides continuous directional information within 2 degrees of accuracy. It is not designed for vehicle use, but does work adjacent to tall buildings. The Palm Navigator includes two applications: MapSync, which stores scanned or Internet-based maps on your PC, and Navigator, which operates the compass and displays maps that you have downloaded. Each map needs an additional 12K or more. (Precision Navigation, Santa Rosa, CA; 888-422-6672; www.precisionnav.com.)

Solus Pro 1.1

PALM

H/PC

\$40.00
direct

 Memory
requirements:
550K

With Solus Pro 1.1 and the DeLorme Earthmate GPS Receiver (\$160 plus \$20 for an adapter cable), you can turn your Palm organizer or Windows CE 2.0 device into a navigational system. You can download multiple maps and directions from DeLorme's Internet-based Solus Map-maker (free to Solus Pro users), Street Atlas USA (\$45), or Topo USA (\$100). Directions average 2K, and maps average 200K. The Earthmate GPS then indicates your position on the map, and alerts you before each turn. (DeLorme, Yarmouth, ME; 800-452-5931; www.delorme.com.)

GAMES

Chess for Windows CE 2.0

H/PC

P/PC

\$79.00
\$39.95
direct

 Memory
requirements:
H/PC,
400K;
P/PC,
300K

What better way to relax than with a game of chess? Available in several languages, Chess for Windows CE 2.0 provides playing levels for beginners and more experienced players. For \$79.00 (H/PC) or \$39.95 (P/PC), you can play against the computer, watch the computer play against itself, or play against an opponent. There are also options for board layouts, chess clocks, speed settings for animated moves, and move replays. Four common move notations are supported: coordinate, algebraic, long algebraic, and international. (Purple Software Ltd., New York; 800-886-4967; www.nwt.com.)



IntelliGolf Birdie edition 3.6

PALM

\$40.00
street

 Memory
requirements:
73K

IntelliGolf Birdie edition 3.6 is an electronic scorecard that tracks 37 performance statistics, from putts to sand saves, and keeps tabs on wagers for 17 scoring variations. The Palm Player Score screen resembles the familiar paper scorecard, but is always legible. Once you upload your game results to your desktop, IntelliGolf computes cumulative statistics, prints scorecards, and converts results to HTML. (Karrier Communications Corp., Seattle; 206-230-8530; www.intelligolf.com.)

Jookerie 1.1

PALM

\$12.00
street

 Memory
requirements:
61K

Jookerie, the Scottish word for trickery, is an apt name for Land-J Technologies' challenging wordplay game. Jookerie 1.1 supports one to five players. To begin, a player draws an obscure word from the program's 1,000-word database, and players enter intentionally incorrect definitions they think their opponents will accept. The winner is the player who chooses the most correct definitions. (Land-J Technologies, Orlando, FL; 407-382-8348; www.land-j.com.)

Palm Golf 1.0

H/PC

P/PC

\$30.00
street

 Memory
requirements:
2MB

A relaxing alternative to the real thing, Palm Golf 1.0 is a simulated 18-hole golf game. The game offers limited challenge and requires a hefty slice of memory, but it has engaging black and white graphics and animated ball movement. You can choose an iron, wedge, putter, or wood; add topspin or underspin to the ball; and set the direction and power of your swing. Scores are displayed at the end of each hole. Palm Golf can be played with up to four players, including one computer player. (ZIO Inter-



When you can't get to the course, Palm Golf can bring 18 holes of action to your Windows CE device. Offering attractive graphics, Palm Golf can be played by yourself or with as many as four players.

active Entertainment Inc., Seoul, Korea; +82 2 512 7506; www.ziosoft.com.)

Tetris 2.21

H/PC

P/PC

\$19.95
direct

 Memory
requirements:
376K

Philips MobileSoft has adapted Tetris, a classic time evaporator, for Windows CE. The object of Tetris 2.21 is to complete as many horizontal lines as possible with solid blocks. While randomly shaped blocks fall down the playing field, you maneuver them to fall in the right spot to complete a solid line. Tetris has options for touch-screen or keyboard controls, and the game has excellent sound effects. (Philips MobileSoft, Campbell, CA; 800-773-1523; www.mobilesoft.com.)

Are You Ready For

B*I*O*M*E*T*R*I*C*S*?

Once the stuff of James Bond movies, biometric security devices—scanners that read your fingerprints, cameras that recognize your face, software that knows your voice—are probably coming to a network or PC near you. In PC Magazine Labs we found that these products are not just dreamware—they're practical answers for serious security challenges.

Biometric systems use physical characteristics unique to each individual to grant—or deny—access to computer resources. These systems go a crucial step beyond traditional passwords or security-access cards, also called *smart cards*, by ensuring that the individual trying to log on is actually the authorized person—not just someone who found a key card in a desk or the Post-It note with a password under the keyboard.

This extra security is important: Extranets, remote-access devices, and VPNs (virtual private networks) provide access to companies' private or sensitive data at points behind the corporate firewalls. Inadequately secured remote access ports are like an open back door on a bank vault. But biometrics is not just about security, it's about convenience; forgotten passwords and lost smart cards are a nuisance for users and eat up a lot of expensive IT time.

Biometric ID systems bring tighter security to networks and greater convenience to users.



REVIEW CRITERIA

We've gathered 11 biometric systems representative of the burgeoning field: six fingerprint scanners, two voice authentication systems, two face recognition systems, and one (the Safelink SAF/nt 2.0) that can be coupled with almost any type of biometric hardware. You may have heard of other types of systems, such as retina or hand scanners, but these are generally used for building access and the like and are not meant for widespread corporate use.

Prices of the products we tested range widely, from as little as \$39 (list) for Miros's TrueFace Network to as much as \$150,000 for Intel-Trak's Citadel GateKeeper, a centralized solution for up to 5,000 users. As the pricing indicates, the products we tested play in different arenas. Entry-level systems (such as the Digital Persona U.are.U Deluxe and voicecrypt) protect only the desktop, letting you lock particular files, portions of your hard disk, applications, or your entire desktop. These are best if you need extra protection on just a handful of machines or for a personal machine.

Moving up the ladder brings you to the corporate-level products. These network-centric systems, which tie in tightly to Windows NT domain security or deliver their own database and administration utilities, are designed for a large number of users.

Passwords Protection

Passwords are cheap (in fact, they're free) to implement—and familiar and comfortable for end users. But they are often written down, which compromises security. And users forget them, consuming IT time and resources.

Fingerprint Recognition

We found the fingerprint scanners too tough to crack, so they are a good choice if security is paramount. But at \$99 to \$199 per user, they can be expensive to deploy to a large user base.

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Face Recognition

These systems are unobtrusive and offer extra security features such as logging an image of every user who approaches the machine. Some require relatively high-end cameras, adding to the cost of deployment, and we found that the security wasn't always bulletproof.

Security Cards

So-called "smart cards" are relatively easy and inexpensive to deploy to a large user base. But they are inconvenient if users lose them or forget them at home, and a found card can let an unauthorized user into the system.

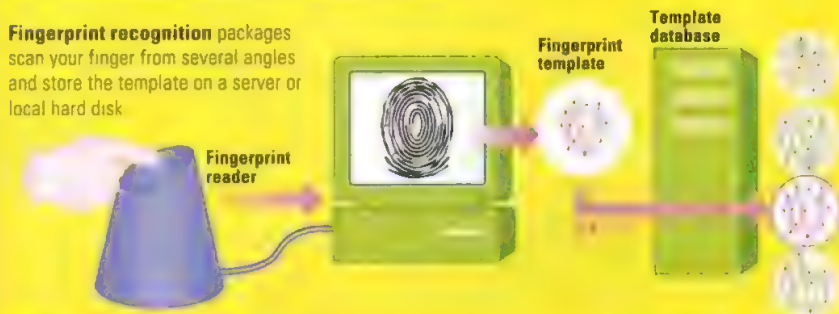
Voice Authentication

Perhaps the least expensive to implement, these systems require no special hardware, and some centralized systems are ideal for granting mobile users remote access. But the most robust of these centralized systems can be pricey (\$50,000 and up).

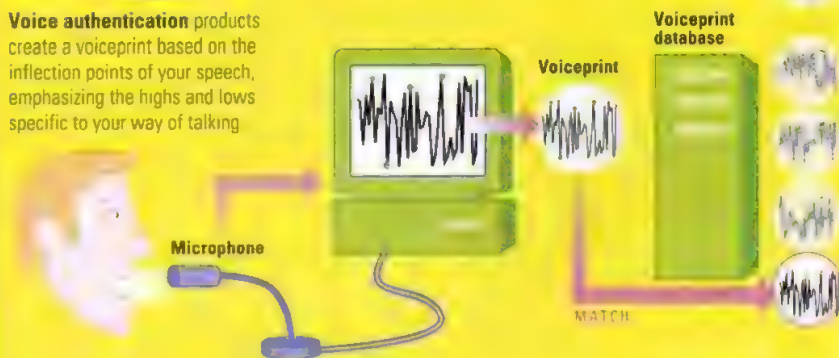
Biometric Security: How It Works

No matter what biometric method you use, the underlying process is similar: To enroll a new user, you must store an encrypted template file of the user's biometric information on a server or client PC. When the user logs on, the template is compared against the new, live information. If it checks out, access is granted.

Fingerprint recognition packages scan your finger from several angles and store the template on a server or local hard disk.



Voice authentication products create a voiceprint based on the inflection points of your speech, emphasizing the highs and lows specific to your way of talking.



Face recognition software uses a camera attached to your PC to capture and map key identifying features. Some also perform a "liveness" test to see how your face moves so that a photo of you cannot be used.



In our labs, we couldn't crack the fingerprint scanners, but we did manage to fool the products from Veritel, Miros, and Visionics at their default sensitivity settings. If security is paramount, investigate the combination of smart cards and biometric devices offered by seven of the products in this review. You lose the convenience, but two-fisted verification is much more difficult to circumvent.

All the products we tested let the administrator set a threshold of sensitivity. Though you might think your fingerprints, face, or voice remain constant from day to day, small fluctuations (cold or moist hands

for fingerprint scanners, different ambient lighting for face recognition, and background noise for voice authentication) can stymie the devices. Setting the sensitivity lower makes the product more forgiving but increases the odds of a *false positive*—a faker logging on as someone else. Higher sensitivity means greater security, but it also means that an authorized user may be erroneously rejected (*false negative*).

Our Contributors: GARY GUNNERSON is a frequent contributor to *PC Magazine*. STEPHEN W. PLAIN is a contributing editor and JAMES KARNEY is a frequent contributor of the magazine. KEVIN YOUNG was the project leader, and JAMIE M. BSALES was the senior associate editor in charge of this story.

As for cost, the jury is still out. Will the price per seat be made up for in fewer calls to the Help Desk and a more productive workforce? The only way to tell for your company is to start some pilot tests with biometric devices and see if using the products will truly decrease the total cost of ownership.

HOW THEY WORK

Although many technologies fit in the biometric space, each works a bit differently. The fingerprint scanners shine a light through a prism that reflects off your finger to a charge-coupled device (CCD), creating an image that gets processed by an onboard computer. It's important to note that the actual fingerprint image is not recorded. Instead, the devices perform a reduction of the image to data points, called *minutiae*, that describe the fingerprint layout, called a *template*.

Voice authenticators use a telephone or microphone to record a user's voice pattern, then use that pattern to validate the person. Since these software systems rely on very low-cost devices, they are generally the least expensive systems to implement for large numbers of users. The standard caveats learned from voice dictation systems apply here. These devices must be able to work with background noise and the variability of off-the-shelf microphones.

Relatively new on the biometric scene, face recognition devices use PC-attached cameras to record facial geometry. Visionics' FaceIt NT requires an analog camera with a frame-grabber card that must perform at high speed, while Miros's TrueFace Network works with any video-conferencing camera.

Once the biometric data is collected, it is encrypted and stored—locally, in the case of the desktop-only products; in a central database for the network solutions. When a user tries to log on, the software compares the incoming biometric data against the stored data.

CHOOSING THE RIGHT SYSTEM

In a corporate network, ID authentication from a biometric system is the first step in

authorizing access. The ID can pass to a Windows Domain Server, a NetWare Directory Services server, or to a directory service using the Lightweight Directory Access Protocol (LDAP). Biometrics can also be the secure entry to a more elegant access architecture using digital certificates and public-key infrastructure (PKI) encryption. (Entrust Technologies is an early leader in this emerging market, and Microsoft has licensed PKI technology from Entrust.) Biometric authentication provides the reliability necessary to build these extensive access schemes. (For more on PKI, see "Your Private Internet," November 17, 1998.)

If you need better security for just a few desktop, the standalone systems from Digital Persona or Veritel may suffice. They are less expensive to buy up front and don't require the network resources or know-how that most others do.

If you are looking to a biometric system to cut down on calls to the Help Desk, a network-centric solution that replaces passwords is your best bet. You'll want affordable hardware and an easy-to-use interface that minimizes IT involvement. In this review, the Identicator BioLogon and Miros's TrueFace Network fill the bill.

If you need better security on a majority of desktops, then a network-centric solution is certainly in order. In this roundup, offerings from Compaq Computer Corp., Identicator Technology, IntelliTrak Technologies, Saflink, Sony Electronics, and Visionics delivered robust security and good network administration tools.

All of the network products we tested support Windows NT. The more elegant implementations from Compaq, Identicator, and Miros integrate seamlessly with Windows NT's GINA (Graphical Identification and Authentication) DLL—the portion of the Windows log-on that identifies and authenticates users—and SAM (Security Accounts Manager), which manages the database of user names, passwords and permissions under Windows NT.

Non-Windows NT users are not left out, however. Products from American Biometric and Miros offer cross-platform support out of the box. Saflink and IntelliTrak, meanwhile, use an external database and hence can be integrated into NetWare or Unix environments.

Most of the products here require the

Editors' Choice

- Network: Saflink SAF/nt 2.0
- Desktop: Digital Persona U.are.U Deluxe



For those who are ready to commit to biometrics, we found two solutions that are especially attractive.

Our Editors' Choice for networkwide deployment is the Saflink SAF/nt 2.0. This flexible solution will work with any type of biometric system—a fingerprint scanner, a camera with face recognition software, or a microphone with voice authentication software—so you can choose a suitable solution on a user-by-user basis. SAF/nt delivers excellent network infrastructure, and its cost—\$149 (list) per seat without hardware—is competitive. Honorable mention goes to the affordable Compaq Fingerprint Identification Technology system (\$99 list per user, including hardware). Its network capabilities and administration are excellent, though limited to

Windows NT environments (Compaq promises broader OS support in future versions).

For a desktop-based solution, whether at home or for a select few PCs in the workplace, our Editors' Choice is the Digital Persona

U.are.U Deluxe (\$199 list per seat). The bundle includes an outstanding fingerprint scanner that isn't as fussy as some (you can place your finger just about anywhere on the sensor). The easy-to-use software lets users protect individual files and applications and create a private, protected partition on the hard disk. Users can also replace any errant application or Web site password with a biometric log-on.



intervention of an administrator to enroll users—a big commitment of IT time. With the Identix TouchSafe Personal, users can access only computers in which they have been enrolled, which is not good if some users tend to roam. The IntelliTrak Citadel GateKeeper, on the other hand, enrolls people with a simple phone call.

PRIVACY ISSUES

Do you want your employer to have your fingerprints on file? Probably not. Device manufacturers understand your need for privacy and do not record actual images of fingerprints, faces, or signatures. Instead, they use mathematical models representing those attributes and store only those models. But it's possible that these "representations" might be able to be used to identify you in any case. And corporations are usually cooperative when authorities ask for an employee photo or work record; who's to say they will be less forthcoming with biometric data?

All we can say definitively is that this is

a new technology area largely untested by civil law, law enforcement, and criminals alike. Corporations should treat this highly personal and sensitive data as such.

While biometric devices may need a bit more time to mature, their prices continue to drop and their sophistication and level of integration continue to increase. With those trends, biometrics is bound to be in your future.

American Biometric BioMouse Plus

\$299 list per seat. Ottawa; 888-246-6687; www.abio.com; 500 at www.pcmag.com/infolink.

● The American Biometric BioMouse Plus is the company's second-generation fingerprint scanner, combining fingerprint recognition with a built-in smart-card reader to enhance security and log-on flexibility. This combination may well be the way of the future, since it offers nearly bulletproof security when the system is active. But a back-door log-on pro-

Comparing the Players

Products that rate well in **desktop setup** are easy to deploy on client desktops. We look for minimum hardware requirements and a straightforward software installation.

For **network capabilities**, robust administration tools and flexible setup options are important. Seamless Windows NT integration and cross-platform support (NetWare, Windows NT, Unix) are pluses.

A better rating in **enrollment** indicates that adding new users is quick and minimally intrusive (especially important for large-scale deployment). A centralized enrollment database is preferable to one that forces users to enroll on each machine they might need to use. Remote enrollment capability is a plus.

For **security**, products that offered administrator-definable sensitivity thresholds and centralized, encrypted databases score best. The option to integrate the system with smart cards or passwords is a plus.

For **total cost of ownership (TCO)**, we consider a system's up-front costs, as well as the likely IT time and resources a product's deployment would demand. We also consider how easy a system is to use day in, day out, to gauge its impact on employee productivity.

FINGERPRINT RECOGNITION	Desktop setup	Network capabilities	Enrollment	Security	Total cost of ownership	Mobile users
American Biometric BioMouse Plus	Good	Good	Fair	Fair	Fair	Fair
Compaq Fingerprint Identification Technology	Fair	Excellent	Good	Good	Excellent	Poor
 Digital Persona U are U Deluxe	Excellent	Poor	Good	Fair	Fair	Fair
Identicator BioLogon	Fair	Excellent	Good	Good	Excellent	Poor
Identix TouchSafe Personal	Good	Fair	Fair	Excellent	Fair	Poor
 Safelink SAFint 2.0	Good	Excellent	Good	Excellent	Fair	Good
Sony Fingerprint Identification Unit	Good	Good	Good	Good	Fair	Poor
VOICE AUTHENTICATION						
Citadel GateKeeper	Excellent	Good	Good	Excellent	Fair	Excellent
voicecrypt 2.01	Good	Poor	Good	Fair	Fair	Excellent
FACE RECOGNITION						
Facelt NT	Fair	Fair	Fair	Good	Fair	Poor
TrueFace Network	Fair	Good	Fair	Fair	Good	Poor

cedure lets a determined user bypass the system fairly easily with a smart-card PIN. This, plus the product's burdensome software architecture and high per-seat cost, keeps it from being an ideal solution.

One of the company's strong suits is platform support. You can implement the BioMouse Plus on any Windows client (Windows 3.1 through NT) and, unlike most other systems here, on most Unix clients. The software suite includes a number of components for establishing both local and domain-level security: an Authentication Server, a Smart Card Issuer, a User Enrollment program, and a Password Maintenance application.

Deployment is no trivial task, however. In an ideal configuration, the Authentication Server (which stores smart-card PINs and fingerprint templates) and the Smart Card Issuer program would be located on the same server. But because the server—a crucial component—lacks security features, the vendor recommends that it be located on a physically secure machine. And unlike with the more elegant solutions from Compaq Computer Corp. and Identicator Technology, the Authentication Server database is not integrated into Windows NT's SAM (Security Accounts Manager), nor is it replicated. This presents the significant risk of user chaos if that "physically secure" machine should

go down. If it does, however, or if a network connection is lost from the client, a user can bypass the biometric requirement with the smart-card PIN.

To enroll a user, the manager issues a smart card via the BioMouse's bundled Smart Card Issuer program. Then the user's finger is enrolled into the Authentication Server. The Authentication Server service must be paused before this can occur, thus temporarily preventing anyone on the network from logging in biometrically. (The company is working to resolve this in the next version.) Once this process is completed, an initial password maintenance session must take place to transfer the user's password to his smart card and, optionally, to an Entrust system (a public-key authentication program).

On the whole, the American Biometric BioMouse Plus needs some refinement. While the hardware works reliably, the software architecture is difficult to administer.—*Stephen W. Plain*

Compaq Fingerprint Identification Technology

\$99 list per seat. Houston; 800-345-1518; www.compaq.com/im/fit/.

● The Compaq Fingerprint Identification Technology is one of the most affordable network biometric implementations we

tested, comprising an external fingerprint scanner and Identicator 1.01 software. Seamless Windows NT integration and a relatively low price make this a good solution for most data-sensitive network environments. Note that it works in conjunction with passwords, so if convenience for users (and IT personnel) is your aim, this isn't your solution.

Our major gripe: Wiring up the Compaq takes up your parallel, mouse, and keyboard ports; the unit's cable includes pass-through connections for the mouse and keyboard but not for the parallel port (the company did this to avoid technical problems associated with parallel pass-throughs). Users therefore lose expandability for scanners, Zip Drives, and the like. Though the system will work with Windows 95 and 98, its real target is Windows NT domains: It replaces the Windows NT GINA in an unobtrusive way and essentially creates a second password out of a template of your fingerprint. Although the Fingerprint Identification Technology doesn't currently support NetWare, Compaq is considering this for future versions, perhaps as an integrated log-on.

Identicator 1.01's unusual back-end integration shows the way for other companies to follow. It works by simply adding the biometric templates to extra blank fields in Windows NT's SAM database.

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This approach means the system works within the standard Windows NT security architecture and is replicated automatically by Backup Domain Controllers. The software also wisely integrates with the User Manager for Domains, adding a biometric enrollment button to the basic user management screens. It's hard to imagine a better way to implement biometrics under Windows NT.

The Compaq product worked flawlessly in our labs. One nice feature we noticed was the security screen that added Windows NT-like workstation protection to our Windows 95 and 98 clients. We did find a couple of things missing: Currently, the software lets you enroll only one finger per user; also, it requires you to use both a fingerprint and a text password to log on. Compaq is already working on both issues.

Its attractive price and excellent integration with Windows NT make the Compaq Fingerprint Identification Technology a front-runner for homogeneous networks.—SWP

Digital Persona U.are.U Deluxe

\$99–199 list per seat. Redwood City, CA; 877-378-2738, 650-261-6070; www.digitalpersona.com; 501 at www.pcmag.com/infolink.



The Digital Persona U.are.U Deluxe is a desktop-only fingerprint authentication system that presents a polished face rarely seen in biometric products. It can't secure your network or provide enterprise-level biometric control (the company is working on these for the next

release). But it does deliver a complete desktop solution for Windows 95 and 98 users who want extra security for certain files, particular applications, hard disk partitions, or entire systems.

The U.are.U system consists of a USB-connected fingerprint scanner, a suite of software, and a separate program called Private Space that lets you create biometrically protected portions of your hard disk and map them to individual drive letters. You can save encrypted files to your "private space" as easily as to your hard disk. The scanner works

with a RADIUS-style challenge/response link that the vendor claims will prevent attempts to gain unauthorized entry by sending out false ID signals.

Both scanner and software are extremely easy to install, and they performed without fail during testing. The U.are.U recognized users with exceptional accuracy and speed, even when fingers were placed on the scanner at odd angles—unlike with other fingerprint readers in this roundup. We found using the system very unobtrusive, and weren't able to fool it in our labs.

Enrolling users is simple, thanks to the bundled Control Center software interface, which lets users quickly enroll from one to ten fingers simply by touching the sensor four times with each digit. Once enrolled, users can log on to the system with a single touch of the scanner—and without a user name prompt, as with other similar products in this roundup.

One impressive Control Center option, called the Password Bank, lets you replace the entry password for any application—including passwords for Web sites—with a fingerprint. To do so, simply hit Control while touching the scanner; then, when prompted for a password, fill in the prompt with your text password and drag it to the original password box.



www.pcmag.com

For the online version of this story and other PC Magazine features, check out our Web site—your best portal to computer products on the Internet. To learn more about biometrics and the latest personal identification products, have a look at these helpful sites.

► The Biometric Consortium

www.biometrics.org
U.S. government group focusing on biometric research. Site includes a useful introduction to biometric technologies, uses, and standards.

► Biometric Encryption

www.emory.edu/BUSINESS/ot/biometric/
Encyclopedia-like discussions of processes, purposes, and implementations of biometric technology.

► 1998 Glossary of Biometric Terms

www.afb.org.uk/glossuk1.html
Extensive list of terms commonly used in biometrics.

► The Biometric Digest

<http://webusers.anet-stl.com/~wrogers/biometrics/>
Monthly publication providing biometric product news. Excellent page of hyperlinks to many biometric vendors.

► The International Biometric Society

www.ibs.org
Academic society dedicated to exploring the mathematical and statistical aspects of biology.

► The BioAPI Consortium

www.bioapi.org
Group formed to develop a standard API for biometric implementation. Discusses biometrics' market penetration and attempts to expand it.

► Connecticut's Biometric Imaging Project

www.dss.state.ct.us/digital.htm
The state's Department of Social Services is implementing biometrics into its service-providing processes—a possible model for future large-scale implementations.

A woman is shown from the waist up, wearing a black dress with white geometric patterns that resemble a stylized 'X' or a network diagram. She has her arms outstretched to the sides. The background is a solid blue color.

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Cisco 2924-XL	\$166 per port

*\$99 per port when \$400 rebate is included.

HP ProCurve 4000M, 8000M, and 2400M prices are based on U.S. list prices effective 11/13/98. HP ProCurve 1600M U.S. list price effective 1/1/99. Savings claims based on U.S. list prices effective 11/13/98 for HP ProCurve 4000M, 3Com SuperStack II 3300, Bay Networks 450T and Cisco 2924-XL switches in 72 port configuration. HP ProCurve 1600M configured with 24 ports. ©Hewlett-Packard Company.

BENCHMARK TESTS

Biometric Security



Whether you're implementing biometrics for security or convenience, a minimum level of each should be expected from any device. In general, we found most of these solutions to be secure, particularly the

fingerprint scanners. Voice and face recognition are not quite as tight at their default settings. In our labs, we subjected the products to a number of test scenarios to determine just how securely and efficiently they could authenticate users. With several products, unenrolled test subjects were able to gain access using some fairly unsophisticated tricks.

Fingerprint recognition

For fingerprint recognition products, we tried several tests, such as dusting for latent prints on the device, lifting them with tape, and reapplying them to the reader. In all cases, we were unable to fool the devices. Our lack of success is a reflection of the relative maturity of fingerprint recognition technology, which has been in use in a number of environments for decades.

Face Recognition

Our experience with face recognition systems was slightly different. We were able to fool both face recognition systems with a mask created with a color printout of a digital photograph of an enrollee. We did have to add a three-dimensional aspect to the mask by

cutting a nose hole and placing an impersonator's nose through the hole; the nose had to be similar to that of the real enrollee for this to work. Although this method worked at the default settings, when we increased the confidence levels, we found it much harder to crack the system. In fact, Visionics' FaceIt NT was only fooled once at the default setting. When we raised the threshold above the rather low default setting of 96 percent confidence, we couldn't get in. Miros's TrueFace Network was more susceptible to the mask attack, but it too rejected the mask at higher threshold settings. The downside to all this is that an increase in the certainty threshold translated into a longer authentication process and an increase in the frequency of false rejections.

Voice Recognition

Of the three biometric categories we examined, we assumed that the voice products would be the easiest to fool. Using a four-track recording device, we recorded a user's authentication sequence and played this back to the system upon entry. This was a little tricky, because both voice recognition systems that we tested randomize the phrases that you're required to repeat. But the phrases do come from a set pool recorded during enrollment, so we only had to attempt an authentication several times before the program randomly requested the sequence we had recorded. But even when this did occur, we were unsuccessful in fooling these systems. We therefore tried a simpler approach: One member of our ZD Labs staff listened to an enrollee authenticate several times and then attempted to mimic the enrollee's voice. On his first attempt, he was able to gain access to Veritel's voicecrypt 2.01 system. This was partially due to the hardware we used: We didn't use the microphone voicecrypt recommends because it was out of stock at the time of testing. Instead, we used the built-in microphone on a Dell notebook—which seemed a reasonable choice for a typical mobile user. In voicecrypt's defense, we did find the product very easy to use, and authentication was efficient even in noisy environments.—*Analysis written by Kevin Young*

The Digital Persona U.are.U Deluxe is an unobtrusive and practical solution for controlling access on the desktop. Though it can't protect your network domain, it's still a wise first step if you're just entering the world of biometric security.—SWP

Identicator BioLogon

\$150 street (as part of Key Tronic Secure Scanner Keyboard). San Bruno, CA; 650-873-8650; www.identicator.com; 502 at www.pcmag.com/infolink.

● The Identicator BioLogon is a compact fingerprint scanner designed for OEM implementation. We tested it as a built-in feature of the Key Tronic Secure Scanner Keyboard, a standard PC keyboard with the Identicator DFR-200 scanner embedded just to the left of the keys. Key Tronic sells this model through distributors, complete with Identicator's BioLogon software. This same scanner module and software system is sold by Compaq, and we like the elegant Win-

dows NT integration of both the Compaq and the Identicator.

The Key Tronic keyboard hooks up in the same way as the Compaq Fingerprint Identification Technology: It plugs into the parallel, keyboard, and mouse ports. And like the Compaq product, there is no parallel pass-through (though Identicator recommends a third-party pass-through adapter from Shuttle Technologies, www.shuttletech.com). Also, the software augments rather than replaces log-on passwords for your users, which is ideal for security—but not so if convenience is your reason for deploying fingerprint scanners.

Because Identicator's easy-to-use software places your fingerprint templates directly into the Windows NT SAM database, administrators can be assured that it won't add an extra layer of management. The enrollment process is user-friendly, with a step-by-step wizard that prompts the user for a fingerprint and then verifies it. In

the soon-to-be-released Version 2.0 of the software, Identicator plans to implement a combined smart-card/fingerprint-scanner option, as well as the ability to log on without the Windows NT text password.

Overall, BioLogon is a superior, easy-to-use security solution. Because it is extremely small, OEMs can integrate it into their products in many ways. And because of Identicator's simple yet effective software, network administrators have an equally wide range of options for incorporating fingerprint authentication into their networks. If your users can give up their parallel ports, this solution is worth a look.—SWP

Identix TouchSafe Personal

\$399 list per seat. Sunnyvale, CA; 888-500-7018, 408-731-2000; www.identix.com; 503 at www.pcmag.com/infolink.

● The Identix TouchSafe Personal is a serial-port fingerprint scanner that comes

SUMMARY OF FEATURES

Biometric Security

FINGERPRINT IDENTIFICATION
VOICE AUTHENTICATION
FACE RECOGNITION
■ YES ■ NO

Products listed in review order

PC MAGAZINE
EDITORS' CHOICE

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	American Biometric BioMouse Plus	Compaq Fingerprint Identification Technology	Digital Persona U.are.U Deluxe	Identicator BioLogon	Identix TouchSafe Personal	Saflink SAF/nt 2.0	Sony Fingerprint Identification Unit	Citadel GateKeeper
Price	\$299 per seat (list)	\$99 per seat (list)	\$199 per seat (list)	\$150 per seat (street)	\$399 per seat (list)	\$149 per seat, not including hardware (list)	\$600 per seat (list)	\$50,000–\$150,000 for 5,000 users (list)
Interface	Parallel, PC Card	Parallel	USB	Parallel	Serial	Hardware-dependent	Serial	N/A ¹
Desktop OSs supported	Windows 95, 98, NT 4.0	Windows 95, NT 4.0	Windows 95, 98	Windows 95, 98, NT 4.0	Windows 95, 98, NT 4.0	Windows 95, 98, NT 4.0	Windows NT 4.0	OS-independent on client
Network OSs supported	Windows NT 4.0, Linux, Solaris, AIX, HP-UX	Windows NT 4.0	N/A ²	Windows NT 4.0	Windows NT 4.0	Windows NT 4.0	Windows NT 4.0	Windows NT 4.0
Uses Windows NT's administration program	■	■	N/A ²	■	■	■	■	■
Back-end database used for biometric templates	Proprietary	Windows NT SAM database	N/A ²	Windows NT SAM database	Proprietary (on client PC)	SQL Server	Security branch of server registry	Any ODBC-compliant database
Biometric database replication	■ (through Windows NT)	■	N/A ²	■ (through Windows NT)	■	■	■	■
Biometric information encrypted between device and host	■	■	■	■	■	Hardware-dependent	■	N/A ³
Administrator-adjustable verification threshold	■	■	N/A ²	■	■	Hardware-dependent	■	■
End-user-adjustable verification threshold	■	■	■	■	■	■	■	■
Adaptive enrollment	■	■	■	■	■	■	■	■
Logs accepted and failed attempts	■	■	■	■	■	■	■	■
End users can enroll themselves	■	■	■	■	■	■	■	■
Supports remote enrollment	■	■	N/A ²	■	■	■	■	■
Supports remote access	■	■	N/A ²	■	■	■	■	■
Integrates with smart cards	■	■	■	■	■	■	■	■
User can replace multiple passwords	■	■	■	■	■	■	■	■
User can protect individual files/partitions on hard disk	■ ■ (both via third-party software)	■ ■	■ ■	■ ■ (both via third-party software)	■ ■	■ ■	■ ■	■ ■
PC Card-based mobile interface	■	■	■	■	■	■	■	■

N/A¹—Not applicable. This enterprise-level solution does not require desktop-level biometric hardware. N/A²—Not applicable. The product is a desktop-only solution. N/A³—Not applicable. The biometric hardware does not

packaged with the company's own IDX-secure software for Windows NT. By providing an additional layer of user verification to Windows NT log-ons, it aims to strengthen security for both desktops and networks. This first-release version of the software does not store a central database on the server, however, which means that users must be enrolled on each machine they are likely to use—a less elegant solution than those from Compaq, Identicator, and Saflink. But for more targeted installation in a workgroup, it is worth a look.

Though its physical casing is similar to that of the Digital Persona U.are.U Deluxe, the TouchSafe has different internal circuitry, including an integrated 32-bit RISC processor for fast comparisons of scanned fingerprints with users' templates. Optionally, it can also accommodate a smart-card reader (\$65 list), though this wasn't available at test time.

The accompanying software, IDX-secure, enables administrators to configure

client workstations to require fingerprint verification for logging on to a Windows NT network. A proprietary database maintains enrolled fingerprint templates on the workstation's local hard disk, forcing administrators to enroll users personally on each machine they may need to use. This approach is insufficient for serious Windows NT domain deployment; an adequate network solution must include, at the very least, a server-based central repository for fingerprint templates.

Conveniently, both enrollment and fingerprint verification are accessible from a single screen. You can enroll all ten fingers, but during our tests we found the program's specific finger references a bit confusing. It numbers your fingers from one to ten without providing a graphical illustration or using standard-parlance finger names. A separate Administration program lets you set the security threshold (the maximum number of users), the false finger detection threshold (such as a 67

percent match or 100 percent match), and the number of verification attempts before rejecting a log-on.

In sum, the Identix TouchSafe Personal has admirable hardware and might be a good choice if you want an extra layer of security for a few desktops. But others offer better network solutions, and the U.are.U delivers more varied end-user software.—SWP

Saflink SAF/nt 2.0

\$149 list per seat, plus cost of verification devices. Tampa, FL; 800-340-6034, 813-636-0099; www.saflink.com; 504 at www.pcmag.com/infolink.



Saflink SAF/nt 2.0, one of the most robust user-authentication packages in this roundup, is our Editors' Choice for networkwide deployment. This software suite offers a rich set of configuration options and supports a variety of biometric methods: fingerprint, voice, face,

connect to the client desktop

This \$149-per-seat solution works with Windows NT's own User Manager to protect an individual workstation or an entire Windows NT domain, including Windows 9x clients. You can use a Windows NT workstation or server to host user accounts for an entire workgroup or domain. To install SAF/nt, you'll need a Windows NT workstation or server running SQL Server

Overall, the SAF/nt is one of the most versatile products in this market and offers an impressive array of features. Its controls and user interface are well designed and accompanied by thorough documentation. If you need biometric access control but want different types and levels of security for different users, this is the only game in town.—*James Karney*

● **Robust but expensive**, the Sony Fingerprint Identification Unit (FIU-500) provides fingerprint authentication security for Windows NT network clients. The bundled software suite—Puppy Secure Logon System 2.0, developed by I/O Software—allows for both workstation- and domain-level data control. Blame the high price (\$600 per seat, or as little as \$425 per seat in volume) on the sophisticated hardware that can be used alone (no

On the whole, the Sony Fingerprint Identification Unit is a robust security package. But it doesn't integrate with standard Windows NT Server administration programs as fully as others do, and it offers no solution for Windows 95 and 98 workstations. Most important, it carries a prohibitive deployment cost.—*SWP*

Citadel GateKeeper

\$50,000–\$150,000 for network-wide implementation.
 IntelliTrak Technologies Inc., Austin, TX; 800-750-6964;
www.intelitrak.com; 506 at www.pcmag.com/infolink.

● A one-time password is the slickest, most secure way to enter into a protected data system. IntelliTrak Technologies' Citadel GateKeeper offers a variation on that theme, granting a random password to users based on voice verification plus a personal PIN number. Designed for large installations with large budgets (\$50,000 to \$150,000, depending on the size of your user population and your call volume), the GateKeeper works with most RADIUS-enabled remote-access servers.

This turnkey solution consists of a Windows NT server, a routing system, proprietary GateKeeper administration software, the appropriate level of telephone connection capability, and any other necessary hardware and software support. All that a user needs in order to access a network protected by GateKeeper is a telephone and his or her voice. All that an administrator needs is a bit of familiarity with Windows NT.

User enrollment and access to any part of the network under GateKeeper's control are automated. The enrollee calls in by telephone and enters a PIN number previously assigned by a security officer. On the first call, a voice prompts for the user's name and for either a series of phrases or a series of two-digit numbers. Once the resulting voiceprint has been made, the user can call for a password. To strengthen security, only one log-on is allowed for a set period (a parameter set by the administrator). Once the password has expired, the user must call the system again to receive a new one. A bit of a hurdle, yes—that's the idea.

In our labs, it took us less than 2 minutes to set up a new account. And unlike with other voice-verification systems we tested, we were unable to gain a password for any unenrolled person, even with a valid user's PIN.

Administration is handled through the GateKeeper Console. Here you can set up new accounts, limit the level and type of access available to individual users, and track activity. The Console lists everyone who has been given a password, shows their related log-ons, and keeps track of any failed attempts to gain

entry. Note that you'll need an administrator who is familiar with Windows NT administration and setting up DSN entries using the ODBC applet in the Windows NT Control Panel.

GateKeeper offers what is arguably the tightest security of the products we tested, though at a price that limits it to major corporate accounts and government agencies that need especially robust access control.—JK

voicecrypt 2.01

\$49.95 list per seat. Veritel Corp., Chicago; 888-837-4835;
www.veritelcorp.com; 507 at www.pcmag.com/infolink.

● Affordable and easy to use, Veritel's voicecrypt 2.01 is a voice authentication solution that encrypts and protects files, directories, and applications on a desktop PC. Though it lacks the sophistication of a full-fledged biometric security system—it won't protect your Windows log-on or

the voice recognition.

During testing, we found that while it's hard to get around voicecrypt's sound barrier, it's not impossible. At the default security settings, one member of our team was able to impersonate another user and gain access to a document protected only by voice (and not by password). Increasing the confidence threshold solved the problem, but doing this leads to more false rejections, which can be a bother. Also, the program doesn't keep track of failed attempts to log on.

The bundle includes the software and a headset-style microphone that plugs into most standard sound cards. Setting up voicecrypt under Windows 95, 98, or NT on a desktop or notebook PC should require no more than 5 or 10 minutes (assuming you already have a sound card). Simply load the CD-ROM, and it automatically installs the software and



secure a network—it does control access to the files or applications you want kept from prying eyes. Voicecrypt is a useful utility for home or business users who want an added degree of security, but its security is hardly bulletproof.

Voicecrypt protects files by storing them in an encrypted *vault* (or partition) on your hard disk. Filenames for these files are encoded, giving them added protection. To gain access to protected files or directories, you simply speak your name into the microphone and then answer a question from your user profile. You can bypass the voice check by answering a set of profile questions using the keyboard. If you're encrypting an entire program, you can require a text password in addition to

prompts you to enroll a user. The manual and interface are very well thought out, and most users will find voicecrypt easy to use. Enrollment is simple, requiring a new user to speak 20 words to generate a voiceprint (with such questions as where you went to school, the birthplaces of your parents, part of your social security number, and the color of your first car).

While voicecrypt effectively provides an extra layer of data protection beyond the Windows password, it's probably not secure enough for truly sensitive data. It does offer ease of use and little or no hardware investment, so if you just need a little biometric protection, voicecrypt may be calling your name.—JK

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FaceIt NT

\$99 list per seat. Visionics Corp., Jersey City, NJ; 201-332-9213; www.faceit.com; 508 at www.pcmag.com/infolink.

● Visionics' FaceIt NT is a face recognition software package that offers log-on and file-access security for Windows NT networks and PCs. This robust solution does the job well, and its special features unquestionably add value. FaceIt gives more granular control over security levels (and tighter security) than Miro's TrueFace, though it's a bit fussier to set up.

The software works with or without passwords and can be combined with any SAPI 3.0-compliant speech product to prompt users for verbal commands. Though it runs on almost any Pentium machine, video requirements are strict: You'll need a Video for Windows-compatible camera that captures at least 5 frames per second at 320-by-240 resolution in 16-bit color. If you're not sure whether your hardware will do the job, Visionics offers Vtest—a free software program that can run a check for you—on its Web site.

Software installation is easy, and you



can use the product with or without a supporting database. The user interface is well designed, but the enrollment process is not as tightly integrated with the native Microsoft User Manager as others we tested.

To enroll a user, you take several images with your camera and then define user information and access rights. An optional "liveness" test is available that focuses on smiling and blinking eyes, thus

reducing the possibility of someone tricking the system with a photograph. You will want to activate this feature, because we were able to trick the system with a photo when only the basic log-on features were enabled. This feature is notably lacking from Miro's TrueFace.

In addition to offering standard log-on and file-access control (including the ability to encrypt individual files), FaceIt can

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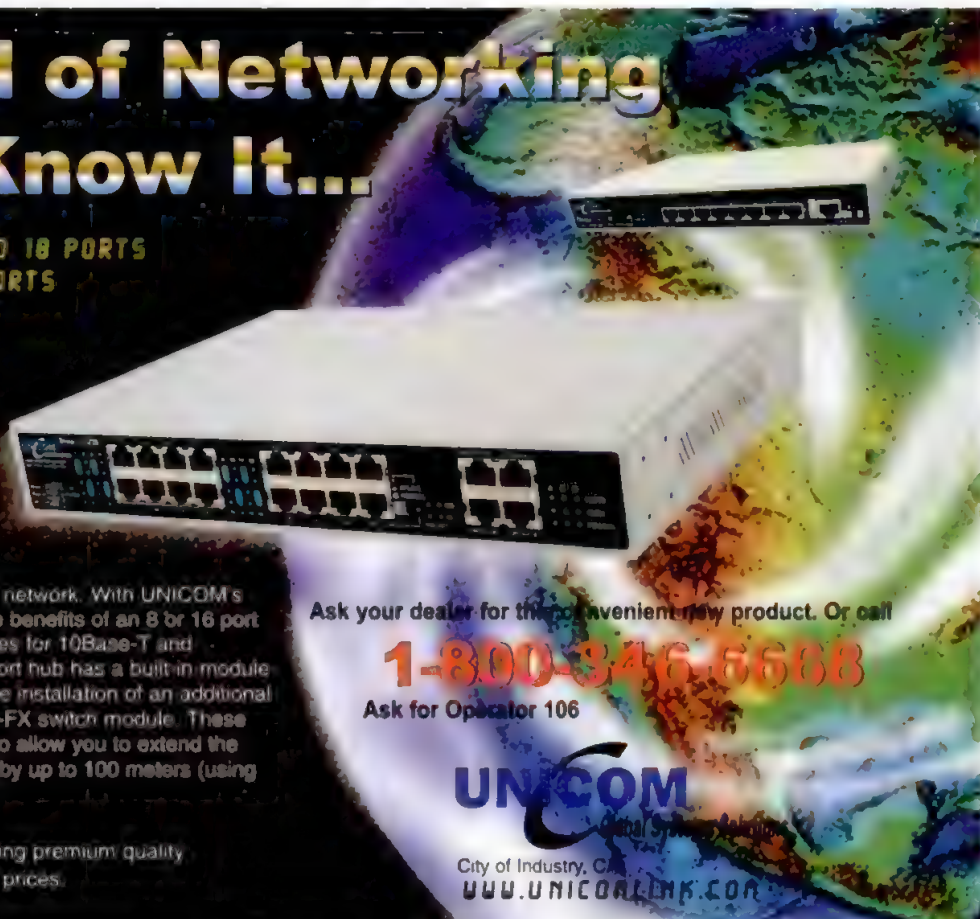
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be set to take an automatic snapshot of anyone who tries to log on unsuccessfully, as well as of anyone who walks by while the machine is unattended. FaceIt can even be programmed to detect whether anyone is actively using the computer; if the user leaves, it can call up the screen saver and lock access, requiring a new log-on. Keep in mind, however, that this routine doesn't verify whether that person is a valid user; when we switched a logged-in user with someone who wasn't enrolled, the feature allowed access until no one was left in the camera's field of view.

FaceIt's combination of image capture, liveness verification, and password barriers offers a high level of security. Its network savvy isn't up to that of Compaq, Identicator, and Miros, but it's a good solution for smaller groups.—JK

TrueFace Network

\$39–\$99 list per seat. Miros Inc., Wellesley, MA; 781-235-0330; www.miros.com; 509 at www.pcmag.com/infolink.

● Versatile platform support and ease of use make Miros's TrueFace Network a

good security system that should fit the needs of medium-size networked offices. If you're looking for video-based biometric security, this is a reasonable choice.

Hardware installation on a Windows NT machine is relatively easy because TrueFace works with a wide range of cameras and doesn't require a video-capture card. A camera is not included, however, so budget \$50 or so for that separately. The software does require SQL Server 6.5 or later, and it's a good idea to have someone familiar with that program run the initial setup, since it requires a bit of database tuning.

As with competing solutions, administrators can track activity and control access to Windows NT domains and workstations. Unlike other solutions, TrueFace isn't limited to Wintel environments. Versions are available for Sun workstations, and the API can be used to harness the engine for other platforms and devices, such as ATMs.

Enrolling new users is very easy; anyone who can operate a PC can manage it. First, TrueFace takes several pictures of

your face and creates an account for you in the database. Next it focuses the camera's attention first on one side of your face and then the other, so as to make it more difficult to trick the software.

In addition to its log-on security features, TrueFace lets you automatically snap photos of users performing almost any action. It can then create a record of the event and document its resolution—entry successful, access denied, and so on. In our labs, we were able to breach the security of the system with a mask—which we made on a color printer—of a registered user's face. Unfortunately, TrueFace does not offer a "liveness" test (checking for facial movements and blinking of the eyes) as does Visionics' FaceIt NT. You can increase the sensitivity from the default thresholds; doing so kept our masked man out.

Miros offers broad hardware compatibility, cross-platform support, a valuable audit trail, and easy operation. Affordable and secure enough for most users, TrueFace Network should be on your short list.—JK 

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Making USB Work



Patience is the watchword for successful USB peripheral installation.

By Bruce Brown

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Many Universal Serial Bus (USB) peripherals are now available, ready to add fun and value to your computer system. But how easy are they to install and get working? Let's look at what it takes to make USB work.

USB connection ports can be found on nearly all new computers. That, combined with improved USB device support in Windows 98, makes adding peripherals to PCs easier than ever. Installing USB devices isn't yet a universally seamless experience, but if you have a Windows 98 PC with a USB controller and USB enabled in the computer's BIOS, installing a single USB peripheral or multiple ones should go well.

The USB standard was originally developed by Compaq, Digital Equipment, IBM, Intel, Microsoft, NEC, and Northern Telecom. The USB Implementers Forum (USBIF; www.usb.org), formed in 1995 by the original seven companies, now has more than 500 members whose joint mission is to promote the development and consumer acceptance of USB peripherals. The promise of the technology is that adding USB peripherals will be quick, easy, and inexpensive.

USB is intended to lower costs for developers and consumers by using standard connectors and eliminating add-in cards. Because power as well as data is distributed through USB cables, some low-power devices can also forgo separate power adapters. The USB specification, currently in revision 1.1, calls for a two-way data channel that supports device hot-swapping, has an aggregate data rate of 12 megabits per second (1.5 Mbps for low-speed devices, such as keyboards), and allows up to 127 devices to be plugged into one PC via a multilevel *tiered star topology* using USB hubs. USB is intended for moderate data transfer in desktop environments with no connection using a cable longer than 5 meters.

UPGRADING THE UPGRADE PROCESS

When you wanted to add a device to your PC in the bad old days, particularly before Windows 95, several obstacles were almost certain to impede the process. First you had to determine whether your computer had the correct port type available. If it did and you didn't need to install an add-in card, you still had to check and often juggle memory addresses, IRQs, and DMA channels—a process fraught with confusing concepts and often frustrating results. Plug and Play with Windows 95 and the PCI bus improved device installation matters significantly, but difficulties, incompatibilities, and device conflicts didn't disappear. Too often, adding ISA card-based peripherals to a Windows 98 system still requires the user to check system resource allocation and either switch resource assignments or eliminate an existing peripheral in order to add a new one.

USER TO USER



Getting around Microsoft Word 97's inability to recognize the MS LineDraw font; labeling chart points with Excel 97; creating shortcuts for shutting down and restarting Windows; restoring disabled *Open* and *Explore* options in the *Start* button's context menu in Windows 98; solving a computer lockup mystery; simulating a full outer join in Microsoft Access; and more. *Page 195.*

UTILITIES



One of the conveniences of Microsoft Windows 95 and 98 is the system tray, the little box in one corner of the taskbar that displays icons for programs that are normally hidden in the background. The system tray can become so cluttered with icons that finding the one you want can be difficult. TrayManager lets you access less-used programs from a single icon that leads to a separate menu. *Page 202.*

INTERNET USER



A single Java program can have dozens of source files. The Java archive (JAR) simplifies distribution for the programmer and makes applets download much faster to the user. We explain how to create JAR files and what syntax to use for Java 1.2 and HTML 4.0 while retaining backward compatibility with older browsers. *Page 206.*



Windows 95 OSR 2.1 added limited support for USB peripherals, but Windows 98 does a much better job, making USB connectivity alone a valid reason for an operating-system upgrade. In large part the Windows 98 advantage is due to bug fixes and to improvements based on testing: The USB Win32 Driver Model (WDM) and the USB driver interface were tested for a longer period and on a wider selection of devices than was the case for Windows 95 OSR 2.1, in which the WDM was referred to as Version 0.9.

In addition, Windows 98 includes three classes of drivers not found in Windows 95 OSR 2.1: WDM Streaming class drivers for digital video and digital audio, WDM HID class drivers for human-interface devices, and STI USB interface drivers to enable scanning and application launching with a button or control on a USB scanner. Before this, device-specific drivers threatened the interoperability of USB devices, potentially negating one of the major promised benefits of the technology.

While individual USB devices have generally worked as expected (with a few notable surprises), earlier attempts to connect multiple USB devices to a single PC elicited concerns that USB peripherals might not "play" well together. In testing for this article, however, both native and upgraded Windows 98 systems were able to run a variety of USB devices simultaneously (although during the initial installations of new devices, previously installed devices were occasionally temporarily lost). And at a live event sponsored by the USB Implementers Forum during Fall Comdex in 1998, a total of 111 devices were connected and running on one PC at the same time. The likelihood of real users ever needing or even trying to attach that many peripherals may be remote; what's important is that it's possible. The 6 to 8 USB devices a typical user will connect should work as well.

CONNECTION BASICS

Connecting a peripheral device to a PC is generally quite simple, as long as your computer is USB-ready. The first step is to be sure that your PC has USB ports, that the USB bus is installed in your PC, and that the ports are connected to the bus. The quickest way to check USB readiness is to open *Start | Settings | Control Panel | System | Device Manager* and look for "Universal serial bus controller" as a listed device. Click on the device for more detail to be sure that both a USB universal host controller and a USB root hub are installed. If any of these elements are missing, you'll need to refer to your PC documentation or BIOS to find how to enable the devices.

Windows 98 automatically loads USB support, but if you're running Windows 95 OSR

2.1, be sure to load USB support from the operating-system CD-ROM if "Universal serial bus controller" isn't listed on your *Device Manager* screen. With the Windows 95 CD inserted, just click on the file *Usbsupp.exe* found in the *Other/Usb* subdirectory.

With USB support installed, attaching a device usually entails plugging it into one of typically two USB ports on the back, side, or front of a PC. You should connect the device with the PC and operating system running. After Windows detects the new device on the USB bus, both Windows 95 and Windows 98 typically display an "Unknown Hardware Detected" message for a few seconds. This message disappears automatically as the process continues, but it can be disconcerting for novices and is the first indication that even with the improved USB support, Windows 98 isn't entirely user-friendly for USB.

The next step in the installation process varies by device, but for those peripherals that don't require their own software loaded first, the operating system generally recognizes the device identification or type and asks for the Windows CD-ROM. At this point Windows

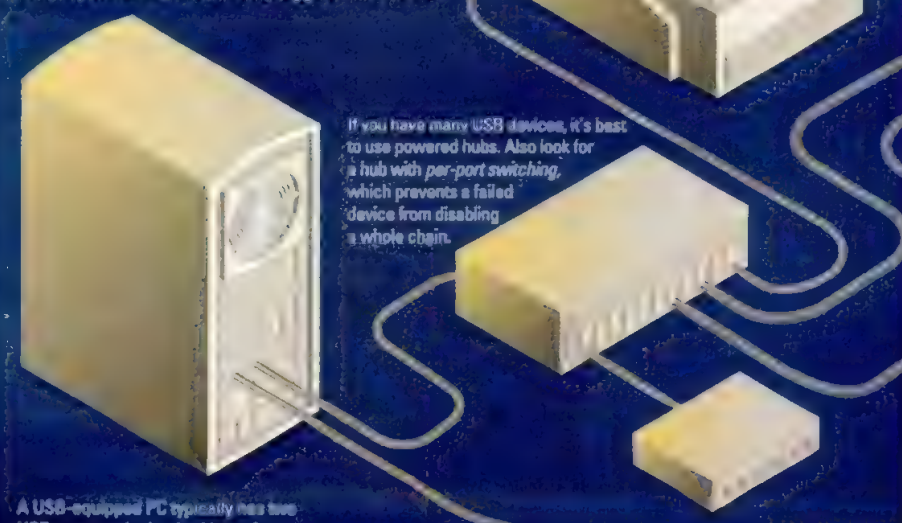
often displays its second, third, and even fourth bits of user-awkwardness. You'll probably be asked for the operating-system CD several times during the installation process. Regardless of whether the required drivers have already been loaded, the installation routine insists on reloading them and persists in not remembering where the Cabinet files are, even after you point to the proper subdirectory the first time. The silliest phenomenon occurs if you unplug a USB peripheral and then plug it back into a different USB port on the same computer: Even if the device was completely installed and running perfectly when plugged into the first port, switching ports means you have to re-install the drivers. We hope future operating-system releases will be more system-aware.

Some USB peripherals, including the Epson Stylus Color 740 ink jet printer and HP ScanJet 4100c scanner, require that you run included software before making the initial device connection. Often you can connect the device and read drivers from the installation disks directly. In testing for this article we followed manufacturers' instructions and had no problems.

If you're attaching just one or two USB peripherals to your PC, you can do so directly; once you've installed each device, you should be able to plug and unplug it at will with no problems or surprises. The expansion potential of USB and the growing number of peripherals, however, suggest that most users

Universal Serial Bus

Universal Serial Bus offers several important advantages over older designs. It cuts costs by eliminating add-in cards and using a standard connector and cable type; it's fast; it makes adding components easier by virtually eliminating system resource conflicts; and best of all, it allows up to 127 devices to be plugged into one PC.



If you have many USB devices, it's best to use powered hubs. Also look for a hub with per-port switching, which prevents a failed device from disabling a whole chain.

A USB-equipped PC typically has two USB ports on the back, side, or front.

will end up with more devices than USB ports on their PCs, which means using USB hubs.

HUB HAPPINESS

USB hubs allow you to hook up multiple devices to your computer via a single USB port, and you can daisy-chain hubs for even more ports. Using hubs is simple in theory, but you're more likely to be successful if you understand a little about how the USB bus provides data and power.

The aggregate USB data-transfer rate for a PC is 12 Mbps, approximately the speed of a typical Ethernet LAN connection. The total power supplied via a USB channel is 0.5 amps, or 500 milliamps (ma). The PC's USB controller and internal hub manage the devices, using a step called *enumeration*, in which each USB device is identified in turn, sharing data bandwidth and power as required.

There are bus-powered hubs available that have no external AC power adapters and draw all power from the PC bus, but if you use bus-powered hubs you limit further connectivity levels (hubs plugged into hubs) and may even preclude using more than one peripheral on a hub. With bus-powered hubs, the total 500-ma load may be taken up by a single device. This is particularly a problem with devices that don't have their own power connectors, such as bus-powered USB digital videoconferencing cameras.

A better idea is to use powered hubs. Not only does a powered hub add an AC adapter to plug in, but good ones provide a full 500 ma per port. To determine hub power required, count the USB downstream ports on a hub and multiply by 0.5 amps. Next look on the hub's AC adapter for the amperage rating. A good powered hub would have an AC adapter rated for at least 2 amps for a four-port hub and at least 3.5 amps for a seven-port hub. Having a bit more than minimal power is even better, to provide the electricity to run LED status indicator lamps. You'll also want to make sure the hub supports *per-port switching*, a feature that prevents one failed device from taking down the whole chain. Without it, if one device attached to a hub has a short, the whole hub and any further generation hubs and devices will likely lose power. Per-port switching isolates each port and shuts down only the port into which a shorted device is plugged.

CORRECT CABLES

One key to success in attaching USB devices is to choose the right cables. Many devices come with attached cables that should be connected directly to PC USB ports or to hubs. Some faster devices such as printers, scanners, drives, and speakers use detachable cables. A detachable cable has a square-end plug, which fits into the device, and the more familiar flat USB connection end, which plugs into a PC or hub

port. As with other peripheral-connection types, the best connection is the one that uses the shortest cable for the job with adequate-gauge wire and shielding.

Because part of the impetus of the USB specification was the need to keep prices low, the specification has precise definitions of the minimum cable gauge per length. Using a longer cable than indicated can cause an unacceptable voltage drop, resulting in unreliable performance or connection failure. The USBIF specifically forbids the use of extension cables and passive pass-through connectors on devices such as keyboards or monitors because of the potential for voltage drop. While some vendors have reported success using extension cables, for the most reliable performance it's better not to use them.

USB PRODUCTS

A wide variety of USB peripherals are now available: keyboards, mice, joysticks and game controllers, printers, scanners, digitizers, digital cameras, video cameras, speakers, modems, network connectors, hard disks, removable storage devices, fingerprint readers, and hubs. The USBIF maintains a list of products on its Web site (www.usb.org). While the earliest devices usually included drivers to work with Windows 95 OSR 2.1, often with mixed results, many of the newer USB peripherals support Windows 98 only. Buyers should be aware that some peripherals with multiple connection ports may purport to support both Windows 95 and Windows 98, but that on closer inspection they connect via USB only with Windows 98 systems and require another connection—such as a parallel port for a printer or analog connection for speakers—on Windows 95 PCs.

REALITY CHECK

It sounds good, but does it work in the real world? In order to test this, we devised a plan with several purposes. We wanted to see how well a selection of typical USB peripherals installed individually and in multiples. We also wanted to observe the installation differences between a Windows 95 OSR 2.1 system and one with Windows 98 and between a native and an upgraded Windows 98 system.

Our test process involved attempting to install each USB device on each of the platforms that supported it. If a device's documentation precluded use with Windows 95 or specifically required Windows 98, we didn't attempt to force it to work on the older operating system. We decided in advance not to call vendor support lines or access Web sites in cases of problems, but we did plan to check written and online documentation included with the product if necessary.

The USB specification calls for a two-way data channel that supports device hot-swapping, and it has an aggregate data rate of 12 megabits per second, approximately the speed of a typical Ethernet LAN connection. (The rate for low-speed devices, such as keyboards, is 1.5 Mbps.)

Some devices, including keyboards and monitors, offer pass-through connectors. These can cause voltage drops, which might result in unreliable performance. It's better to use a hub with more ports or a second hub.

No cable should be more than 5 meters long. For best results, use the shortest cable practical and one with adequate-gauge wire and shielding. Avoid extension cables, which can cause voltage drops.





We tested on two desktop PCs. The first, a Micron Millennium Max 400, was a native Windows 98 system with Phoenix BIOS 4.0 Rel 6.0, a 400-MHz Pentium II processor, and 128MB of RAM. The second test-bed was an NEC PowerMate P2166M with AMI BIOS 1.00.03, a 166-MHz Pentium MMX CPU, and 32MB of RAM. We tested the devices on the NEC system with both Windows 95 OSR 2.1 and the Windows 98 upgrade.

The devices used in testing represented a cross section of USB peripheral classes: a Belkin 3-Button USB Mouse (www.belkin.com), a Digital Persona U.are.U fingerprint reader (www.digitalpersona.com), Entrega 4-Port and 7-Port USB Hubs (www.entrega.com), an Epson Stylus Color 740 ink jet printer (www.epson.com), an HP ScanJet 4100cI

USB mouse and a standard PS/2 mouse worked simultaneously.

The Microsoft Natural Keyboard Elite also worked only under Windows 98. Others have written that this keyboard can at times be made to work under Windows 95 OSR 2.1, but the Microsoft Web site specifically states that the USB adapter for the keyboard is supported only under Windows 98. As with the mouse, the systems recognized the keyboard, requested Cabinet files, and activated the device without a reboot. The Microsoft product could be used

The scanner successfully installed on the Windows 95 system and on the native and upgraded Windows 98 systems.

The Epson Stylus Color 740 printer supports a USB connection only under Windows 98. With Windows 95 you must connect via parallel port. The installation software instructs you to turn off the PC to plug in the printer, but that step isn't necessary; again, it's a leftover from pre-USB peripheral configuration. The printer worked fine on both Windows 98 systems.

The Xirlink C-it PC Camera installed and worked well under both Windows 95 and Windows 98. As with several of the other devices, you're instructed to install the bundled software before plugging in the camera. On the Micron PC the system also looked for Cabinet files, but with the NEC PC, installation proceeded automatically without further user intervention in the Windows 98 upgraded and Windows 95 OSR 2.1 configurations.

After we installed the Kodak DC260 Digital Zoom Camera's software, connecting the camera via USB cable was easy under both Windows 95 and Windows 98 in both versions. The only glitch was a software default to normal serial communications, reset via a Kodak connection preference menu.

You can install and use the Iomega USB Zip 100 drive without rebooting the PC if you want to copy the drivers manually from the installation disk. If you run the normal Iomega installation software, the system needs to be restarted for the drive to be recognized. This drive worked fine with both versions of Windows 98 but does not support Windows 95.

The Microsoft Digital Sound System 80 speakers were somewhat problematic. Because the speakers have both analog and audio USB connectors, you can use the speakers with Windows 95, even using OSR1. But the digital capabilities of the speakers are supported only under Windows 98, and then fully only if the CD-ROM drive or DVD-ROM drive in the system supports digital audio extraction (DAE), a capability for which the speaker software tests. On the NEC Windows 98 upgraded system, the speakers supported two-way volume and muting via the speaker-mounted buttons and supported on-screen controls via USB connection, but the CD-ROM drive did not support DAE and therefore would not play digital audio.

The NEC system was also able to reboot with the speakers attached via USB cable—a significant factor, since that was not possible with the Micron desktop system with Phoenix BIOS. As reported elsewhere by *PC Magazine*, it's common for desktop Phoenix BIOS revisions with USB support to hang during the boot sequence if any USB device with a configuration descriptor longer than 248 bytes is

Keys to Success: USB Dos and Don'ts

Do run Windows 98. A limited selection of peripherals run under Windows 95 OSR 2.1; for the widest selection of devices and for the best results when attaching multiple peripherals, Windows 98 is required.

Do have your Windows 98 CD-ROM disk handy. You'll probably be asked to insert the CD the first time you install each new peripheral on either USB channel, even if the files or drivers needed are already installed. To save time have the CD ready, or better yet, install the Windows 98 CAB files in a subdirectory on your C: drive if you have room.

Don't use bus-powered or under-powered hubs, which can significantly restrict the number of supported peripherals. Instead, use self-powered USB hubs with at least 500 milliamps per

channel. Hubs should also feature per-port switching, so one bad peripheral won't shut down all devices on a hub, and LED indicators for device status.

Don't use cables longer than 5 meters, and don't use extension cables or connectors, including passive pass-through connectors on monitors or keyboards. While extension cables and connectors are available, significant signal degradation is a risk if you use them.

Do check that previously installed components still work after you install a new USB peripheral. Our testing showed that rebooting the system after installing a new USB peripheral often suffices to get everything working again, but it is common for individual devices to stop working during installation of a new peripheral.

simultaneously with a PS/2 keyboard, so it's a good choice for some multiple-player games.

The Digital Persona U.are.U worked identically on all three test-beds. To install this device, first you run the company's software, which recognizes the operating system and automatically loads the correct drivers. Next you plug in the device, help it find the Cabinet files if they're not in the default location, and then run the U.are.U software a second time to initialize the device's fingerprint authentication system.

When you run the required HP ScanJet 4100c installation software, the program automatically turns off the PC to allow you to plug in the scanner, an unnecessary remnant of pre-USB peripherals. You plug in the scanner and restart the PC. After you reboot, the New Hardware wizard asks for the Cabinet files.

flatbed scanner (www.hp.com), an Iomega USB Zip 100 removable storage device (www.iomega.com), a Kodak DC260 Digital Zoom Camera, (www.kodak.com), a Microsoft Digital Sound System 80 and Natural Keyboard Elite (www.microsoft.com), and a Xirlink C-it PC Camera-Model XVP-510 video camera (www.xirlink.com).

INDIVIDUAL DEVICE INSTALLATION

The Belkin mouse requires Windows 98, so we didn't attempt to install it under Windows 95. On both Windows 98 systems the mouse was recognized as a Cypress USB mouse. The systems looked for and loaded the human interface device file (Hiddev.inf) from the Windows Cabinet files, and then the mouse started working immediately without a restart. The

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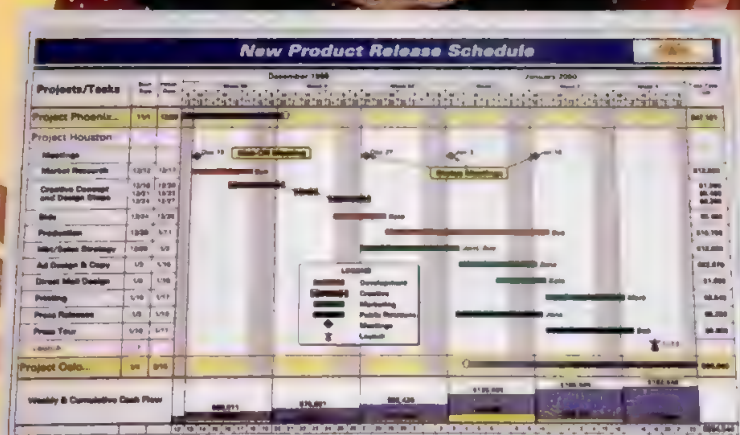
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attached, as was the case with the Microsoft speakers. The workaround is to unplug the speakers when you reboot and then plug them back in again after the system comes up. The real answer will be a fix from Phoenix.

The Entrega hubs loaded fine using Cabinet files on the Windows 98 systems and using a driver supplied on a floppy disk on the Windows 95 OSR 2.1 system. It wasn't necessary to reboot the systems to start using the hubs.

MULTIPLE DEVICE INSTALLATION

Windows 95 OSR 2.1: The NEC Windows 95 OSR 2.1 test-bed supported only five of the test devices: the Digital Persona fingerprint reader, Entrega hubs, HP scanner, Kodak digital camera, and Xirlink video camera. With the hub installed, each of the other four devices installed easily, without losing the connection to any of the existing devices. Once all four were installed, all the devices worked at the same time. Although Windows 95 supported only a limited subset of the test devices, even on a machine with only 32MB of RAM the system was able to run all the connected devices.

and printer did not cause other devices to get lost during USB enumeration, possibly because these last four devices all install via their own software.

Once all devices were plugged in, we tried two tests to strain the system. The first test entailed starting the Xirlink video-monitoring software and then running the scanner or printer. In each case, the camera image on the computer display went to a green screen because of a lack of system resources. After rebooting and finding all devices stable once again, we attempted to use the HP copy utility to scan a photo on the HP scanner and print it directly on the Epson printer, attached to the same USB chain. This test didn't work, and the scanner was lost, though the printer stayed active. We rebooted and switched the scanner USB cable to the PC's second USB port (it was the sole device

The Micron PC's CD-ROM drive did support DAE, so we started an audio CD playing (with the analog cable unplugged so we'd be sure the sound was coming via USB), started up the Xirlink video-monitoring software, scanned a photo with the scanner, and then printed the scanned image. All during the scanning and printing, we kept waving at the camera to watch for image degradation and kept the CD playing so we could listen for loss of audio throughput. The bottom line was that no degradation of video or audio quality was noticeable, a testament to the system's ability keep track of all the content and the benefit of 128MB of RAM.

The last test was to try the scanner copy utility on the same USB chain. Not unexpectedly, the requests of the two devices conflicted, and as with the upgraded Windows 98 system, the scanner was lost. As with the other system, however, plugging the scanner into the Micron PC's second USB port enabled direct copying from the USB scanner to the USB printer.

In sum, the Windows 98 native system worked similarly to the Windows 98 upgraded system, with the exception of a Phoenix BIOS conflict with the speakers during system booting and a better ability to handle multiple data streams because of the Micron PC's greater memory resources.

IEEE 1394 (FireWire)

USB isn't the only new PC connection standard. Following on the heels of USB development and device proliferation is IEEE 1394, also called FireWire. FireWire is designed for much faster throughput than USB, however, supporting speeds of 100, 200, and 400 Mbps. Like USB, FireWire uses a tiered star topology, but it also supports peer-to-peer connections without hubs, allowing up to 63 same-speed devices to be connected to the same bus and up to 1,023 buses to be interconnected.

While 1394 chip, BIOS, and operating-system support trails that for USB (look for the first PC peripherals to start appearing in number in mid 1999), FireWire isn't a replacement for USB. USB connections will likely be used for lower-speed peripherals, such as input devices and controllers, while FireWire will be more appropriate for high-bandwidth applications, such as cable modems, LAN connections, digital video, and consumer AV devices.

Windows 98 upgrade: Our NEC system with the Windows 98 upgrade supported all nine peripherals plus two Entrega powered hubs, but the system required the most patience of the three test-beds. We started by plugging in the keyboard, mouse, Kodak digital camera, and Iomega Zip 100 drive, in order, into the seven-port hub, and all worked fine. Then when we added the fingerprint reader, we couldn't access the camera's CF disk. Rebooting once brought up the camera and the Zip 100 drive, but the fingerprint reader wasn't active. After we rebooted a second time, all five devices were active and stable.

After plugging the four-port hub into the remaining port on the seven-port hub, we then added the Xirlink camera. Again we lost the Kodak camera, but rebooting brought all devices back. Adding the speakers, scanner,

on that port) and were able to run the copy utility and both scan and print via USB on the same PC in one operation. Even though the scanner had to be attached to the second USB port, this was an impressive demonstration of USB's ability to keep track of devices working together.

Native Windows 98 system: The last multiple-device test was run on the Micron native Windows 98 test-bed. The results of plugging the devices in one at a time were similar to the process on the upgraded Windows 98 system, with multiple reboots at times necessary to attain a state of stable recognition for all devices. The biggest difference involved the Microsoft speakers, which, because of the Phoenix BIOS problem mentioned above, had to be unplugged each time the system was rebooted. After all nine devices and the two hubs were plugged in and running, the system remained stable.

LAST WORDS: IT WORKS!

The bottom line is that while Windows 95 OSR 2.1 significantly limited our selection of supported peripherals, all of the tested devices worked on both native and upgraded Windows 98 test-beds, with no noticeable differences between the native and upgraded operating systems. We were also able to hook up nine devices successfully via one PC USB port and two powered hubs on both systems, though as mentioned above, the Microsoft USB speakers had to be unplugged during system boot-up on the test-bed with Phoenix BIOS.

Patience paid off in our testing. When we installed a new USB device, the existing devices would sometimes go off-line, but in our tests a new, cold start was all it took to power up all of the connected devices. The reshuffling during device installation reminded us of what it's like to wait for a play to begin. The people who arrive early get their seats but have to reshuffle with each new arrival. Once the audience is complete and all have reshuffled for the final time, the play can begin and can be expected to have few interruptions. That fairly well describes our USB device installation experience. **PC**

Bruce Brown is a contributing editor of PC Magazine.



USER TO USER

MS LineDraw Characters in Word 97

Word 97 doesn't seem to recognize the MS LineDraw font. This is an issue because some legacy programs that I depend on use MS LineDraw to create lines when generating files that I need to incorporate into my documents.

When I installed Office 97 on my new system, I took care to ensure that the MS LineDraw font was on the system. The Fonts applet in Control Panel sees the font, and both WordPad and Excel recognize it and use it correctly. However, I've not been able to make Word 97 see the font no matter what I try. Do you have any suggestions for how to make Word see this font?

Tony Holland-Batt
via the Internet

PC You don't mention whether the legacy programs you depend on are DOS or Windows programs, which may make a difference. As you probably know, the line-drawing characters in MS LineDraw are not the best way to draw lines in Word. They're a holdover from DOS programs, which were generally limited to text-based interfaces. Because they weren't graphical—meaning they didn't define images bit by bit—they needed characters that could link together on the screen (or printer) to form rather than actually draw lines.

The line-draw characters are part of DOS's high-order character set, characters 128 through 255. You can enter one of them in most DOS programs or at the DOS command line by turning NumLock on, holding the Alt key down, typing the ASCII value for the character, and releasing the Alt key. Alt-170, for example, is the upper-right-hand corner for a rectangle.

Entering these characters with the Alt key and numeric keypad works even in many Windows programs. However, most Windows programs don't need characters to create lines. Typically they take advantage of the Windows graphical environment to let you draw or paint

lines instead. MS LineDraw provides these characters anyway, largely for compatibility with documents created in DOS programs that depend on the text characters for lines.

Microsoft chose to end support for a number of fonts in Word 97, including MS LineDraw. But although there is no way to get around Word 97's blind spot for the font, there are some workarounds. The intended substitute for MS LineDraw is Courier New, which offers the same characters. To see them, choose *Insert | Symbol* and then *Symbols*, type *Courier New* in the *Font Text* box (you won't find it in the drop-down list), hit Enter, and

is that there are several versions of the Courier New font, and with some versions the MS LineDraw characters don't map correctly. Microsoft says that there shouldn't be any problem with Courier New 2.0, which is the version that originally shipped with Windows 95. (To determine the version of Courier New on your system, go to Control Panel, choose *Fonts*, and then double-click on *Courier New* or highlight *Courier New* and choose *File | Open*.)

I tried some tests on a Windows 98 system that had Courier New 2.45 installed. Results were mixed. I created a file in Word 6 with all the high-order MS LineDraw characters entered three different ways. For the first set, I used the *Insert | Symbol* command. For the second, I created a DOS text file, inserted it with *Insert | File*, and then formatted the text

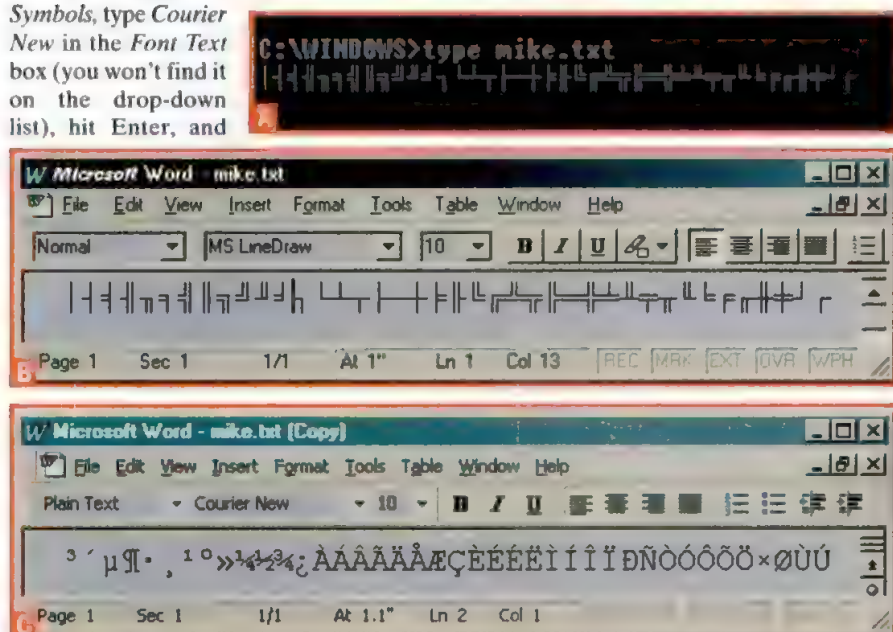


FIGURE 1: In section A, the DOS line-draw characters appear in a DOS command window. In B is the same file as it appears in Word 95 formatted in the MS LineDraw font. And finally, C shows the same file as it appears in Word 97 formatted as Courier New. Strangely, Word 97 uses the right font but translates the characters wrong.

scroll to the end of the character set.

When you open a file that has MS LineDraw characters, Word 97 is supposed to map those characters to the equivalent characters in Courier New. Unfortunately, the conversion doesn't always work smoothly. One of the problems, according to Microsoft,

as MS LineDraw. For the third, I turned on NumLock, entered each character by holding down the Alt key while typing the ASCII code on the numeric keypad, and then formatted the text as MS LineDraw.

When I opened the file in Word 97, Word reformatted all three sets of characters as Courier New. More important, Word mapped all of the line-draw characters properly. Everything also worked as promised when I added the file to a document with the *Insert | File* command. This suggests that if your legacy programs are Windows-based and are producing Windows files using the MS LineDraw characters, you should have no problem using

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them with Word 97. At least, you should have no problem if you have the right version of the Courier New font.

You'll have more of a problem if the legacy programs are DOS-based. When I tried opening or inserting the same DOS file that I used for Word 6, Word 97 formatted it as Courier New but didn't map any of the characters correctly. I found a workaround, however. First make sure MS LineDraw is installed on the system. Open the file in WordPad, select the text, format it in MS LineDraw, choose *Edit | Copy*, go to the Word 97 file, and choose *Edit | Paste*. Word will automatically convert the text to Courier New. Curiously, in my tests many of the high-order foreign-language characters were mapped to the wrong characters in Courier New, but all the line-draw characters were mapped correctly.—*M. David Stone*

Public MyChart As Object

Sub Labeler()

```
On Error GoTo Trap
ActiveChart.ChartArea.Select
Set MyChart = ActiveChart
UserForm1.Show
Exit Sub
```

Trap:

```
MsgBox "Please select a chart before running this macro!"
```

End Sub

Private Sub cmdCancel_Click()

```
UserForm1.Hide
```

End Sub

Private Sub UserForm_Activate()

```
RefLabelRange.SetFocus
```

End Sub

Private Sub cmdOK_Click()

```
On Error GoTo RangeError
LabelRange = RefLabelRange.Text
i = 0
MyChart.ApplyDataLabels Type:=xlDataLabelsShowValue, LegendKey:=False
For Each cell In Range(LabelRange)
    cval = cell.Value
    i = i + 1
    If i > MyChart.SeriesCollection(1).Points.Count Then Exit For
    MyChart.SeriesCollection(1).Points(i).DataLabel.Characters.Text =
```

```
cval
```

```
Next cell
```

```
UserForm1.Hide
```

```
Exit Sub
```

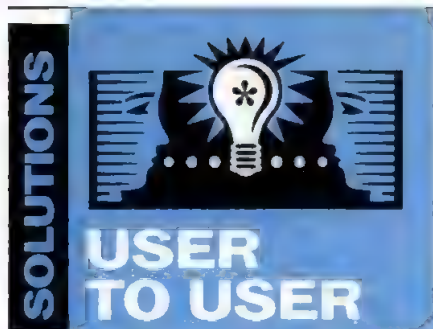
RangeError:

```
MsgBox "Invalid Range!"
```

```
UserForm.Hide
```

End Sub

FIGURE 2: This Excel macro automates the process of setting labels for chart data points.



Labeling Chart Points

I would like to label points on an XY chart in Excel 97 using labels in a separate worksheet range rather than the values of the points. For example, I'd like to title my x-axis *taste* and my y-axis *ripeness* and then have points labeled *apple*, *banana*, and so on. Can this be done in Excel?

Matt Mode
London, UK

PC Unfortunately, Excel doesn't provide a direct way to use a set of worksheet labels as data labels for an XY chart. The chart



UI does let you label data points with their values, and after you've done that, you can modify your labels to whatever you wish—but it's a clumsy and time-consuming process. To modify an individual label, you need to select it twice. The first mouse click selects all labels in a series, and the second click refines the selection to the individual label on which you've clicked. (Don't click that label twice in quick succession or Excel will interpret your action as a double click and display the *Format Data Labels* dialog box.)

Once you've selected your label, Excel confirms that action by displaying a rectangle with handles around the label. Now you can type whatever you please and your entry will replace the default label.

Obviously, this isn't much fun if you need to modify more than half a dozen or so labels. The VBA code in Figure 2 automates the process, applying the text values stored in a user-specified worksheet range as the source

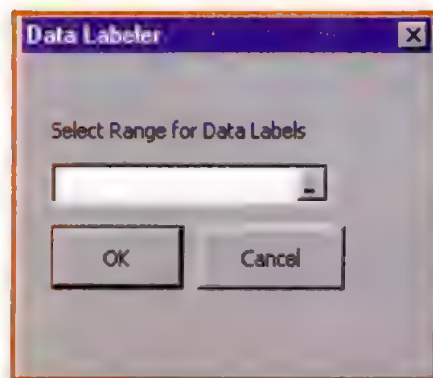


FIGURE 3: The macro in Figure 2 uses this custom dialog box to query you for the label range.

of replacement labels for the first data series in the current chart. Note that before executing the macro, you must select the chart.

The macro employs a small custom dialog box (shown in Figure 3), named *UserForm1*. The dialog box includes three controls, named *cmdOK*, *cmdCancel*, and *refLabelRange*. You can download this macro from PC Magazine Online. You'll find it in the PC Tech archive for this issue.—*Craig Stinson*

Shortcuts to Shut Down And Restart Windows

I know a good way to quit Windows 95 or 98 quickly: You simply create a shortcut that includes this command: `rundll32.exe user,ExitWindows`. This tip is even more effective if you assign a hotkey combination to the shortcut. But, can you tell me the command to use to restart Windows?

Chris Santos
Jakarta, Indonesia

PC Normally, only programmers have access to the API functions exported by Windows function libraries (DLLs). But if a function is written in a very special way, it can be triggered using the utility program Rundll32.exe (or Rundll.exe for a 16-bit DLL). Alas, though the programmer documentation for Windows includes detailed discussions of the thousands of regular API functions, there is no similar documentation for the functions that can be called through Rundll32.exe. Still, by peeking at the insides of a DLL to learn the names of its functions, and then trying them with Rundll32.exe, you can work out some solutions by trial and error, including the requested command to restart Windows.

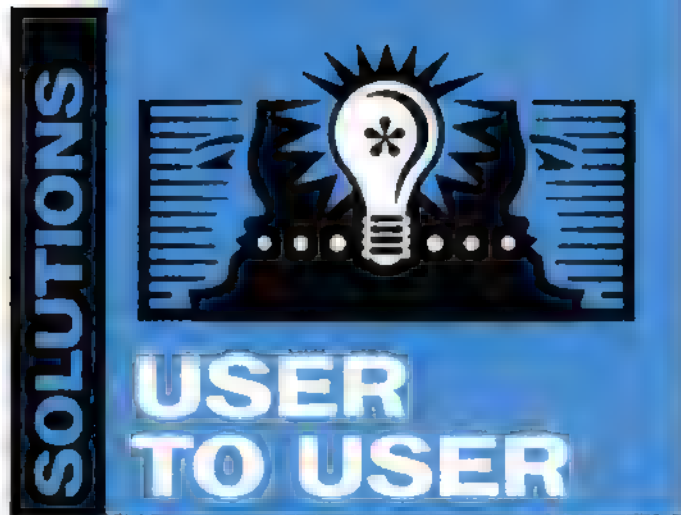
A shortcut whose command line is `rundll32.exe shell32.dll,SHExitWindowsEx` will close all programs and prompt you to log on again. This is the fastest kind of restart, and may be sufficient. If you need a complete system reboot, use the command line `rundll32.exe shell32.dll,SHExitWindowsEx 2`. And to shut down and power down the system, `rundll32.exe shell32.dll,SHExitWindowsEx 5`. Terminating this command line with numbers other than 2 and 5 may produce other effects, but do remember the "error" in trial and error. On my modern Pentium-based PC with Advanced Power Management, terminating that command with the digit 1 shut down the system in such a way that it would not restart until it was unplugged and then plugged in again.

To create a desktop shortcut for one of these commands, right-click the desktop to bring up the context menu and choose *Shortcut* from the *New* menu. Enter the specified command line and click the *Next* button. In each case the command will be `rundll32.exe` followed by a space and a DLL name (with or without the .dll extension), a comma, and the name of a function within the DLL. There must be no space before or after the comma, and the DLL name itself cannot contain a space. Give the shortcut an appropriate name and click *Finish*. You're done! If you want to change the shortcut's icon, right-click the shortcut, choose *Properties* from the resulting menu, and click the *Change Icon* button on the *Shortcut* tab.

Another Rundll32 feature you may find handy is a shortcut to launch the control panel applet of your choice. The syntax for this command is:

```
rundll32.exe  
shell32.dll,Control_RunDLL  
filename.cpl,@n,#
```

Here `filename.cpl` is the name of a file containing one or more control panel applets,



`@n` is the zero-based index of the desired applet within that file, and `#` is the zero-based number of the desired initial page in a multipage applet. The `@n` and `#` items are optional, though `@n` must be present if you want to use `#`. For example, ending the above command with `timedate.cpl,@0,1` launches the *Date/Time Properties* applet (the first and only applet within *Timedate.cpl*) with the *Time Zone* page selected. The same command ending with `sysdm.cpl,@0,3` launches the *System Properties* applet with the *Performance* page selected. If you make extensive use of partic-

If a function is written in
a very special way, it can
be triggered using the
utility program
Rundll32.exe.

ular applets, you can use this information to define shortcuts that launch those applets directly. Do note that the `#` argument to specify the initial page of a multipage applet does not work in every case.

There are many other commands that can be launched through Rundll32.exe. If you discover one that's truly useful, don't hesitate to write and tell us about it.—Neil J. Rubenking

Fixing Disabled Menu Items

When you right-click the *Start* button in Windows 98, you may find the *Open* and *Explore* options grayed out and inoperable. If so, chances are you've installed TweakUI and opted to deselect one or more of the unused drives in TweakUI's *My Computer* tab. For some reason, doing so has disabled these two menu items. The fix: Put the check marks back.

Don Schmidt
Vancouver, Washington

PC Normally when you right-click the *Start* button, you get a context menu whose first two items are *Open* and *Explore*. Choosing one of these allows you to navigate the

folders and subfolders that represent the *Start* menu. This is a nice shortcut when you want to clean up your *Start* menu, and if you're accustomed to using it, the disabling of these two items can be quite disconcerting.

TweakUI—originally part of the free PowerToys utility set, from Microsoft—has moved up in the world. It's now part of the Windows 98 Resource Kit, so more people than ever are using it. Judging by the number of questions we've received about disabled items on the *Start* button's context menu, we'd say quite a few have experimented with the *My Computer* tab. This tab lists all 26 possible drive letters, each with a check box to its left. Drive letters that don't actually exist on your system will never be shown in Explorer, whether they're checked or not. Drive letters that do exist will be shown only if they are checked.

Unfortunately, if you choose to suppress one or more drive letters, you lose the use of the *Open* and *Explore* items on the Windows 98 *Start* button's context menu. The only solution we know of at this time is to restore all the check marks in TweakUI. You may need to restart Windows or log off and on again before the two menu items will be reenabled.—Neil J. Rubenking

Computer Lockup Mystery Solved

I recently set up a Windows 95 computer to connect to a Novell 3.12 network, then found that the computer would no longer restart in MS-DOS mode. Before I finally solved this, I had three more machines with the same problem! Behind the *Restart in MS-DOS mode* option on the *Shut Down* menu, there is a PIF file in the Windows directory named *Exit To Dos.pif*, which loads *Command.com*. Interestingly, *Exit To Dos.pif* does not exist when Windows 95 is first installed but is created on the fly the first time the option is requested. It may just happen that this first request occurs when the DOS environment pointer to *Command.com* has been altered by Novell to point to a *Command.com* stored on the server.

At the time that the PIF file tries to load *Command.com*, networking has been disabled, so the reference is to a nonexistent drive. The computer locks up, because *Command.com* cannot be loaded but *Command.com* is needed to display an error message! The solution is either to edit *Exit To Dos.pif*, or to delete it, disconnect the network cable, reboot, and select *Restart in MS-DOS Mode* so that it will be re-created correctly.

Cal Williams
Essex Junction, Vermont

PC I'm very happy to present a solution for this long-standing mystery. If your system won't restart in DOS mode, this tip may be your salvation. To edit *Exit To Dos.pif*, navigate to your Windows directory in Explorer and locate the file. Note that you won't see the .pif extension. Even if you've unchecked the option to hide file extensions for known file types, Explorer still suppresses the extensions of PIF and LNK files. Right-click the file, choose *Properties*, and click the *Program* tab. The *Cmd line* edit box should point to the copy of *Command.com* that's in your local Windows directory; commonly this would be *C:\Windows\Command.com*. Make that change and click *OK*. Now click *Shut Down* on the *Start* menu and try to restart in DOS mode. This time it should work fine.—Neil J. Rubenking

Simulating a Full Outer Join in Microsoft Access

I need to combine two tables in order to determine a total amount paid. The first table has two fields, *BasketId* and *PaymentA*. The second table has two fields, *BasketId* and *PaymentB*. I want to create a combined table that contains *BasketId*, *PaymentA*, *PaymentB*, and *Total*.

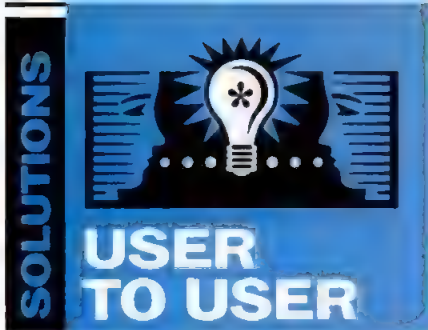
How do I create the combined table?

Ricardo Ellera Saliba
Belo Horizonte, Brazil

PC You need to create a special type of query called a *full outer join*. Normally when you create a query and join two tables on a common field, such as *BasketId*, the result consists only of rows that match. Each row in the result combines one row from each input table where the input rows have the same value in the common field. With an outer join, the rows that don't match from one of the tables are also preserved. When it's a right outer join, the unmatched rows from the table on the right side of the equal sign in the join condition are preserved. When it's a left outer join, the rows from the table on the left are preserved. A full outer join, on the other hand, preserves unmatched rows from *both* tables—producing a result that includes both the matched and the unmatched rows in both tables, essentially combining the two.

Microsoft Access, however, does not provide direct support for full outer joins. We spoke with Microsoft regarding this issue, and although it was unable to say when direct support for full outer joins would appear in Access, we were able to come up with a suitable workaround.

The solution consists of several queries. The



first is a left outer join. Its purpose is to return all of the rows in *Table1* as well as the matched rows in *Table2*, based on *BasketId*:

```
SELECT Table1.ID, Table1.PaymentA,
Table2.PaymentB,
[PaymentA]+Nz([PaymentB]) AS Sum
FROM Table1
LEFT JOIN Table2 ON Table1.ID =
Table2.ID;
```

I'll name this query *Left Outer Join*.

The second query is a right outer join, restricted to return only the unmatched rows in *Table2*, based on *BasketId*:

```
SELECT Table2.ID, Table1.PaymentA,
Table2.PaymentB,
Nz([PaymentA])+[PaymentB] AS Sum
FROM Table1
RIGHT JOIN Table2 ON Table1.ID =
Table2.ID
WHERE (((Table1.ID) Is Null));
```

I'll name this query *Restricted Right Outer Join*.

A union query that combines the result of the left outer join and the result of the restricted right outer join produces a simulated full outer join, resulting in your desired combined table:

```
SELECT [Left Outer Join].ID,
[Left Outer Join].PaymentA,
[Left Outer Join].PaymentB,
[Left Outer Join].Sum
FROM [Left Outer Join]
UNION SELECT [Restricted Right Outer
Join].ID,
[Restricted Right Outer
Join].PaymentA,
[Restricted Right Outer
Join].PaymentB,
[Restricted Right Outer Join].Sum
FROM [Restricted Right Outer Join];
```

A database containing the sample data and the left outer join, restricted right outer join, and full outer join queries can be downloaded from www.pcmag.com/pctech/download/archives98.html. Look for the file named *Fullout.mdb* in the archive for this issue.

Some final advice: Watch out for similarly named columns such as *PaymentA* and *PaymentB*. They often indicate faulty database

design, even when they're present in separate tables. Whether your database design is indeed flawed depends on a lot of factors that we don't have space to consider in detail here.—Sal Ricciardi

Play Favorites with Your Favorites

Here's a neat trick for users of Microsoft Internet Explorer 4.0: By changing the icons of individual favorites, you can make them more interesting and attractive, and easier to find. It's very simple:

Choose *Organize Favorites* from the *Favorites* menu, or navigate to the *Favorites* subfolder in your Windows folder. Then right-click on the favorite whose icon you want to change and select *Properties*. On the *Internet Shortcut* tab, click the button labeled *Change Icon*. You can now choose any icon you want for that favorite. Click *OK*, and the icon for that favorite has now been changed everywhere, including the *Start* menu, the *Favorites* menu in IE4, and the *Favorites* panel in IE4!

Vivek Lakhi
Scarsdale, New York

PC Setting specific icons for favorites is even easier than that. Don't bother with *Organize Favorites*, and don't navigate to the *Favorites* folder in Explorer. Instead, open any of the three Favorites locations (the *Favorites* folder from the *Start* menu, or the *Favorites* menu or panel in IE4) and right-click the item you want to modify. Choose *Properties* from the pop-up menu, and proceed as above. An icon change in any one of these locations will be reflected in all three. If the *Favorites* panel doesn't reflect the change immediately, highlight the item and press F5 (Refresh).

In case you have a large collection of favorites, this tip can make your favorite Favorites stand out. You may also want to move some of the less-used items into subfolders, organized by category. Here again, you can rearrange your favorites directly in any of the three Favorites locations. Point to the item you want to move, then press the left mouse button and hold it down. Drag the item to the target subfolder; it will open. Drop the item in the opened menu.

When you move a Favorite into or out of a subfolder, the change immediately affects all three Favorites locations. However, the order of items within each location is stored separately. You can reorder the items by dragging, but you'll have to do it separately in the *Start* menu's *Favorites* menu, IE4's *Favorites* menu, and IE4's *Favorites* panel.—Neil J. Rubenking **PC**

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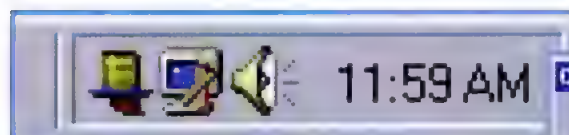
Unclutter Your System Tray

The system tray on Windows' taskbar gives quick access to programs that run in the background, but it can get so cluttered with icons that finding the one you want becomes a challenge. This issue's utility, TrayManager, lets you replace less-used tray icons with a single icon that gives access to them. Right-clicking on the TrayManager icon displays the other tray icons in a menu.

TrayManager runs under Windows 95 and Windows 98. An

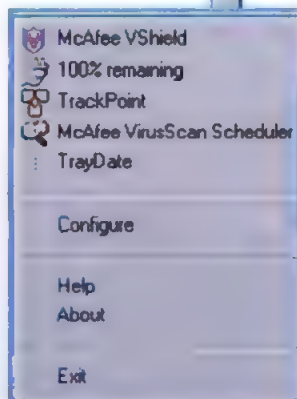
article about how to use TrayManager and how it was programmed is available on our Web site at www.pcmag.com/pctech/index-ut.html. A link to download the utility and its source code can also be found here.

Steven E. Sipe, the author of TrayManager, is a developer based in Wilmington, North Carolina. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

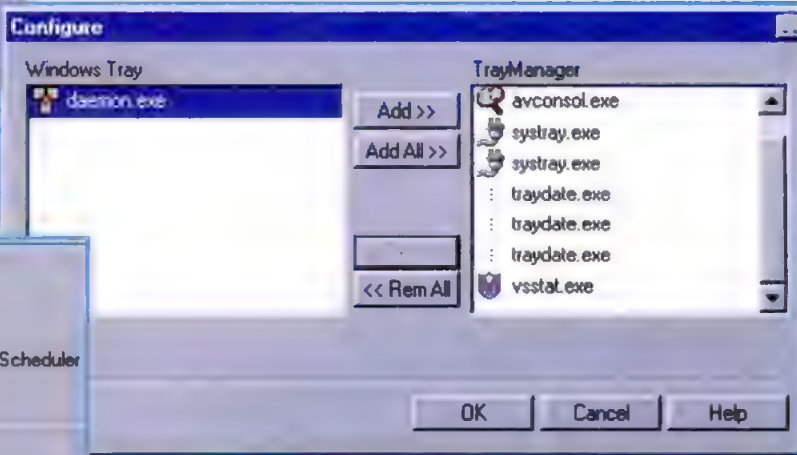


TrayManager lets you hide tray icons that you don't often need to access. Right-click on the TrayManager icon, shown here as the left-most icon in the tray, to access the hidden tray icons.

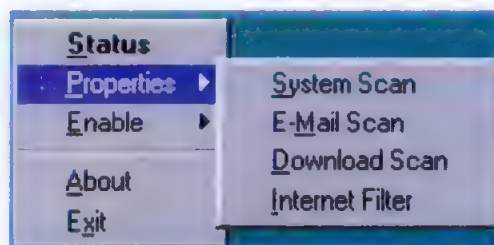
TrayManager's right-click context menu lists the hidden tray icons. You can click on tray icons in TrayManager's menu, just as you would if they still resided in the tray. To add or remove icons from this list, select Configure.



Shown here is the menu that appears when you right-click on the tray menu item McAfee VShield from within TrayManager. The program's context menu appears at the location where the mouse happens to be when you click.



The Configure dialog lists the items in the tray in the left-hand pane and the items hidden by TrayManager on the right. To move items between lists, select them and click Add or Remove. TrayManager can detect most tray icons.



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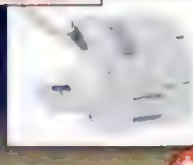


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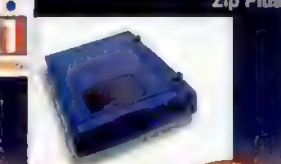


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Java Archives in Java 1.2

By William Robert Stanek

Like most technologies for the Web, Java is a fast-moving target, and just about the time you think you have this stuff all figured out, someone somewhere changes the rules. Sure, all the changes are meant to make the Web faster and more fun, but change requires an effort.

We'll take a look at the new ways Version 1.2 and HTML 4.0 let you work. You'll find out how to create archive files and use them to simplify distribution of Java programs. We'll also examine a new HTML tag strategy for use with archives. Even if you aren't a programmer, you'll be able to use this information to enhance your Web site's use of Java.

WORKING WITH JAVA ARCHIVE FILES

An applet is a Java program designed to be run within a browser. If you've ever worked with applets, you know that a single Java program can have dozens of source files associated with it. There are files for the Java classes that store the actual code, files for graphics used in the applet, and files for other types of media as well. To make it easier for programmers and non-programmers alike to use Java applets, Java 1.1 introduced an archive system that allows you to bundle all the source files for an applet into a single file called a Java archive (JAR).

Here, the term *archive* refers simply to a file that contains a collection of files. If you've ever backed up your hard disk to tape or used a ZIP compression tool, you've already worked with

archives. Just as most ZIP tools compress files before storing them in the archive to save space, files in Java archives are also compressed to save space. In fact, Java uses the ZIP compression format in its archives.

An added bonus of using compressed archive files is that they can greatly improve the performance of applets, and these performance benefits extend to both sides of the client/server Web equation. Compressed archives take up less file space, and your browser can download these archives many times faster than the original uncompressed files. On the Web server, the time savings are also substantial. With separate files, the server generates a separate HTTP transaction for each file. Each transaction uses server resources and can take a few seconds to generate. Thus, by bundling many files into a single file, you can speed up the server's response time and reduce the dreaded wait—and we all hate to wait.

Until recently, Java archives were used primarily with applets, and because of this most people think of a Java archive as something you can use only with applets. However, Java 1.2 introduces enhancements so that you can easily create and use archives for applications, too. If the Java Development Kit is installed on your computer, you can create archives with the Java archive tool, JAR. Normally you run JAR from the DOS or Unix command line. Figure 1 summarizes the syntax for the most common uses of JAR.

Unlike most other command line tools, JAR

doesn't require you to use a hyphen or slash to specify options. When you create an archive, you normally pass JAR two options: *c* to create the archive and *f* to specify the filename of the archive. These options are followed by the archive name, which should end with the *.jar* extension, and the list of files to include in the archive. In this example, JAR creates an archive called *myarchive.jar* that contains the files *ccMain.class*, *vid.class*, and *banner.gif*:

```
jar cf myarchive.jar ccMain.class
vid.class banner.gif
```

If you've obtained an archive created by someone else, you may want to know what files the archive contains. To do this, you can use the *t* option to show the archive's table of contents. The following example examines the table of contents for an archive called *myarchive.jar*:

```
jar tf myarchive.jar
```

Usually, you will want Java to tell you exactly what's happening when you are archiving files or trying to display the table of contents; the *v* (for *verbose*) option lets you do this. You combine this option with the other options discussed previously. When you create archives with the *c*, *v*, and *f* options, JAR gives you a great deal of information about the archive process. You'll see the files being added to the archive, the original sizes of those files, the compressed file sizes, and how much space you've squeezed out of the files. For example, if you create the following archive:

```
jar cvf keyarchive.jar keys.class
comp.class talk.class
```

the Java archive tool would detail the main archival process something like this:

```
adding: keys.class in=19612 out=4810
deflated 75%
adding: comp.class in=9554 out=4105
deflated 57%
adding: talk.class in=42453 out=9021
deflated 78%
```

Here the Java archive tool adds three class files to the archive. The original file sizes are shown with the *in* parameter. The compressed file sizes are shown with the *out* parameter. And the amount of space squeezed out of each file is shown last. As you can see, the original size of the three files is about 70K, yet JAR manages to squeeze the files into an archive of about 18K—quite a difference when you are transferring files using a standard modem.

Java Archive Commands

Operation	Command
Creating a JAR file	<code>jar cf jar-file input-file(s)</code>
Viewing the contents of a JAR file	<code>jar tf jar-file</code>
Extracting the contents of a JAR file	<code>jar xf jar-file</code>
Extracting specific files from a JAR file	<code>jar xf jar-file archived-file(s)</code>
Running an application packaged as a JAR file (with Version 1.1)	<code>jre -cp app.jar MainClass</code>
Running an application packaged as a JAR file (with Version 1.2; requires <code>Main-Class</code> manifest header)	<code>java -jar app.jar</code>
Invoking an applet packaged as a JAR file	<code><applet code=AppletClassName.class archive="JarFileName.jar" width=width height=height></applet></code>

FIGURE 1: These common Java archive file commands are used with JAR to create, view, extract, and run Java archives.

USING ARCHIVED APPLICATIONS AND APPLETS

Thanks to the JAR enhancements to Java 1.2, you can now run archived applets and applications. If you pass the Java interpreter the `-jar` command, for example, you can run archived applications. Java applications packaged in JAR files can also be executed directly on the Windows or Solaris desktop.

How the automatic execution of archives works depends on the type of system you're using. When you install the Java 1.2 Runtime Environment on a 32-bit Windows system, the installation program registers a default association for JAR files. You can then run JAR files automatically by invoking the Java interpreter with the `-jar` option. For Solaris 2.6, Sun actually extended the kernel so that the operating system would recognize JAR files. The kernel extensions allow Solaris 2.6 to invoke the Java interpreter directly with the `-jar` option, and in this way Solaris systems can execute archive files as if they were native Solaris executables.

Working with archived applets is a bit different from running an archived application, because you need to tell the Java applet viewer or Java-enabled browser how to use an applet. Normally, you do this by creating a Web page that contains the `<APPLET>` tag. This tag has attributes that let you tell the browser about the applet, such as its class name and its location.

Using the `<APPLET>` tag, you can associate one or more archives with an applet. When you use archive files with applets, the browser always looks first in the archives for the necessary class and resource files. If the browser can't find these files in the archives, the browser then tries to obtain the files from the server—just as it would if the archives weren't present.

The attribute you use to specify that an applet's in a Java archive is aptly named `ARCHIVE`. The `ARCHIVE` attribute is always used in conjunction with the `CODE` attribute. The `CODE` attribute specifies the name of the main applet class, and the `ARCHIVE` attribute specifies the location of the archive, which can be defined as a relative or absolute URL. For relative URLs, your browser uses the applet's code base to determine the location of the archive. As you may recall, the code base is simply the location of the applet's source code, which can be specified with the `CODEBASE` attribute.

In the following example, the main applet class is `myapp.class`, and the browser looks for it in the associated archive file. If the browser cannot find the applet class, the browser then looks on the server for the applet class.

```
<APPLET CODE="myapp.class"
  ARCHIVE="myapp.jar"
  WIDTH="250" HEIGHT="250">
</APPLET>
```

If an applet uses more than one archive, you can enter the URLs for the archives in a comma-separated list. In the following example, the applet uses two archives. The first archive is called `strider1.jar`, and the second archive is called `strider2.jar`.

```
<APPLET CODE="strider.class"
  ARCHIVE="strider1.jar,
  strider2.jar"
  WIDTH="300" HEIGHT="300">
</APPLET>
```

BYE-BYE, <APPLET>, HELLO, <OBJECT>

Under HTML 4.0, the `<OBJECT>` tag is replacing the `<APPLET>` tag as the preferred way to add applets to a Web page. The `<OBJECT>` tag is a multipurpose tag designed to provide a ready upgrade path for current and future types of media. A general-purpose tag for various types of media makes a lot of sense. After only a few years of Web development, there are already many different media-related tags that serve essentially the same purpose.

In fact, the single `<OBJECT>` tag is meant to replace the `<IMG>` tag for images, the `<APPLET>` tag for applets, the `<IFRAME>` tag for internal frames, and the `<EMBED>` tag for embedded objects.

When you use the `<OBJECT>` tag, you usually need to tell the browser what type of code the object refers to with the `CODETYPE` attribute. The code type for Java applets and applications is `application/java`. The code type for Java archives is `application/java-archive`. If you've worked with Web-based content types before, you know that `application/java` and `application/java-archive` are MIME (Multipurpose Internet Mail Extensions) types and that browsers often use the MIME type to determine how to handle various types of information.

Another important difference is that the `CODE` attribute of the `<APPLET>` tag is not available. In its place, the `<OBJECT>` tag uses an attribute called `CLASSID`, which specifies the URI (Uniform Resource Identifier) for the applet. URIs are a bit different from URLs. With URIs, you start by telling the browser the protocol or language, and then you identify the structure to take action on. To separate the protocol/language from the structure of the URI, you use a colon, as in *protocol:structure*.

With Java, the protocol/language for the URI is always specified as `java`, but the action

you take depends on how you are using the applet in your Web page. If you want to invoke an applet's `start()` method directly, you tell the browser the path to follow to the `start()` method, which is normally `program.start`:

```
<OBJECT CODETYPE="application/java"
  CLASSID="java:program.start"
  WIDTH="250" HEIGHT="250">
</OBJECT>
```

If you want to invoke a specific Java class within an applet, you can specify the class. In the following example, the applet's main class is called `custom.class`, and this class is specified after the `java:` designator:

```
<OBJECT CODETYPE="application/java-
archive"
  CLASSID="java:custom.class"
  WIDTH="300" HEIGHT="300">
</OBJECT>
```

Before you look forward to saying bye-bye to the `<APPLET>` tag and its cousins, you should know that it will be a while before you'll be able to use the `<OBJECT>` tag exclusively in your Web pages. The reason for this is that older browsers don't understand the `<OBJECT>` tag and won't know how to display and run your applets or other embedded objects.

For backward compatibility, insert the `<APPLET>` tag between the begin `<OBJECT>` tag and the end `<OBJECT>` tag. Be sure that the `<APPLET>` tag immediately follows the begin `<OBJECT>` tag. In the following example, if the browser can't use the `<OBJECT>` tag, the browser tries to use the `<APPLET>` tag:

```
<OBJECT CODETYPE="application/java-
archive"
  CLASSID="java:custom.class"
  WIDTH="300" HEIGHT="300">
  <APPLET CODE="custom.class"
    ARCHIVE="myclasses.jar"
    WIDTH="300" HEIGHT="300">
  </APPLET>
</OBJECT>
```

On the Web, where every bit and second counts, bundling applet files into a compressed archive really does make a difference. Now that you can launch a Java archive with a simple click, we should start to see a lot more applications for our desktops. 

William Robert Stanek is the creator of CentralDrive.Com. His latest book, Server-Side JavaScript: The Definitive Guide, will be published in June. You can contact him at netdesigns@tvpress.com.

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104279	233MMX/32MB/3.2GB/56K/12.1"TF	\$1099
104280	233PII/32MB/3.2GB/56K/12.1"TF	\$1899
104283	266PII/64MB/4.3GB/56K/14.1"TF	\$2439

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47383	233MMX/32MB/4.0GB/12.1"TF	\$1499*
101593	233PII/32MB/4GB/56K/12.1"TF	\$2429
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Kensington Technology Group

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Belkin

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59208	StackPro II 16-Port 10/100 Hub	469.95

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107699	SW108 8-Port Switch w/2 FREE NIC Cards	189.95
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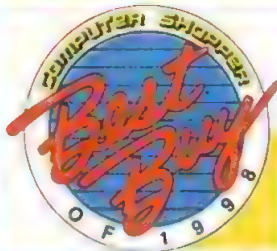
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CP9090 IBM PC300GL PII/350MHz, 32MB, 3.2GB, Win 98, DT	\$1019.00
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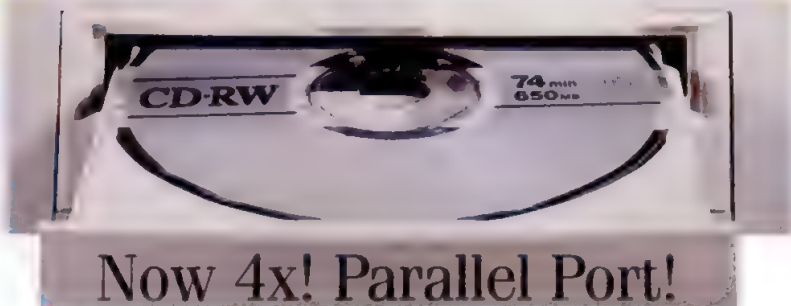
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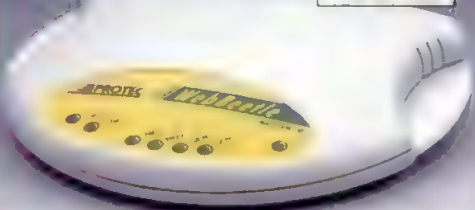
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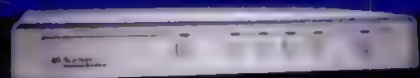
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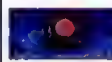
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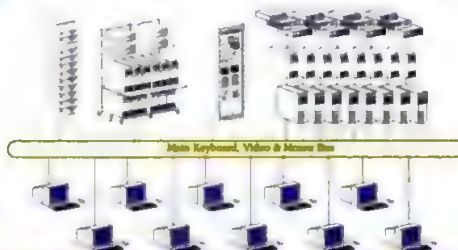
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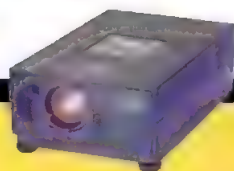
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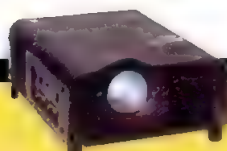
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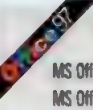
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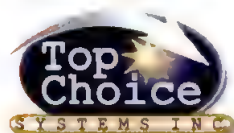
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1.5 512 1024MB	3.3V	—	—	—
1.5 1024 2048MB	3.3V	—	—	—

30 PIN DIMMS

30 PIN DIMMS	AM	72	PC-100	PC-133
1MB	3.3V	—	—	—
2MB	3.3V	—	—	—
4MB	3.3V	—	—	—
8MB	3.3V	—	—	—
16MB	3.3V	—	—	—
32MB	3.3V	—	—	—

HARD DRIVES

HARD DRIVES	AM	72	PC-100	PC-133
288MB	3.3V	—	—	—
360MB	3.3V	—	—	—
440MB	3.3V	—	—	—
528MB	3.3V	—	—	—
616MB	3.3V	—	—	—
704MB	3.3V	—	—	—
792MB	3.3V	—	—	—
880MB	3.3V	—	—	—
968MB	3.3V	—	—	—
1056MB	3.3V	—	—	—
1144MB	3.3V	—	—	—
1232MB	3.3V	—	—	—
1320MB	3.3V	—	—	—
1408MB	3.3V	—	—	—
1496MB	3.3V	—	—	—
1584MB	3.3V	—	—	—
1672MB	3.3V	—	—	—
1760MB	3.3V	—	—	—
1848MB	3.3V	—	—	—
1936MB	3.3V	—	—	—
2024MB	3.3V	—	—	—
2112MB	3.3V	—	—	—
2200MB	3.3V	—	—	—
2288MB	3.3V	—	—	—
2376MB	3.3V	—	—	—
2464MB	3.3V	—	—	—
2552MB	3.3V	—	—	—
2640MB	3.3V	—	—	—
2728MB	3.3V	—	—	—
2816MB	3.3V	—	—	—
2904MB	3.3V	—	—	—
2992MB	3.3V	—	—	—
3080MB	3.3V	—	—	—
3168MB	3.3V	—	—	—
3256MB	3.3V	—	—	—
3344MB	3.3V	—	—	—
3432MB	3.3V	—	—	—
3520MB	3.3V	—	—	—
3608MB	3.3V	—	—	—
3696MB	3.3V	—	—	—
3784MB	3.3V	—	—	—
3872MB	3.3V	—	—	—
3960MB	3.3V	—	—	—
4048MB	3.3V	—	—	—
4136MB	3.3V	—	—	—
4224MB	3.3V	—	—	—
4312MB	3.3V	—	—	—
4400MB	3.3V	—	—	—
4488MB	3.3V	—	—	—
4576MB	3.3V	—	—	—
4664MB	3.3V	—	—	—
4752MB	3.3V	—	—	—
4840MB	3.3V	—	—	—
4928MB	3.3V	—	—	—
5016MB	3.3V	—	—	—
5104MB	3.3V	—	—	—
5192MB	3.3V	—	—	—
5280MB	3.3V	—	—	—
5368MB	3.3V	—	—	—
5456MB	3.3V	—	—	—
5544MB	3.3V	—	—	—
5632MB	3.3V	—	—	—
5720MB	3.3V	—	—	—
5808MB	3.3V	—	—	—
5896MB	3.3V	—	—	—
5984MB	3.3V	—	—	—
6072MB	3.3V	—	—	—
6160MB	3.3V	—	—	—
6248MB	3.3V	—	—	—
6336MB	3.3V	—	—	—
6424MB	3.3V	—	—	—
6512MB	3.3V	—	—	—
6600MB	3.3V	—	—	—
6688MB	3.3V	—	—	—
6776MB	3.3V	—	—	—
6864MB	3.3V	—	—	—
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7040MB	3.3V	—	—	—
7128MB	3.3V	—	—	—
7216MB	3.3V	—	—	—
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7392MB	3.3V	—	—	—
7480MB	3.3V	—	—	—
7568MB	3.3V	—	—	—
7656MB	3.3V	—	—	—
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8008MB	3.3V	—	—	—
8096MB	3.3V	—	—	—
8184MB	3.3V	—	—	—
8272MB	3.3V	—	—	—
8360MB	3.3V	—	—	—
8448MB	3.3V	—	—	—
8536MB	3.3V	—	—	—
8624MB	3.3V	—	—	—
8712MB	3.3V	—	—	—
8800MB	3.3V	—	—	—
8888MB	3.3V	—	—	—
8976MB	3.3V	—	—	—
9064MB	3.3V	—	—	—
9152MB	3.3V	—	—	—
9240MB	3.3V	—	—	—
9328MB	3.3V	—	—	—
9416MB	3.3V	—	—	—
9504MB	3.3V	—	—	—
9592MB	3.3V	—	—	—
9680MB	3.3V	—	—	—
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9944MB	3.3V	—	—	—
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10120MB	3.3V	—	—	—
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10648MB	3.3V	—	—	—
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11264MB	3.3V	—	—	—
11352MB	3.3V	—	—	—
11440MB	3.3V	—	—	—
11528MB	3.3V	—	—	—
11616MB	3.3V	—	—	—
11704MB	3.3V	—	—	—
11792MB	3.3V	—	—	—
11880MB	3.3V	—	—	—
11968MB	3.3V	—	—	—
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12320MB	3.3V	—	—	—
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13904MB	3.3V	—	—	—
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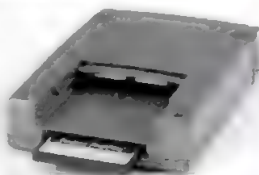
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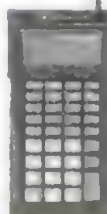
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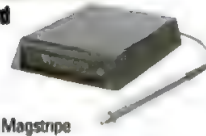
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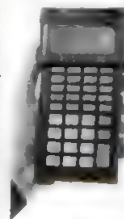
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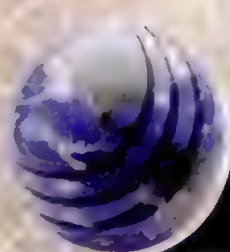
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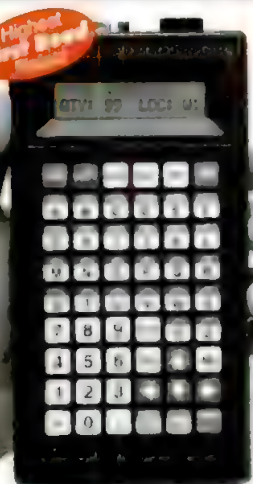


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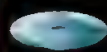
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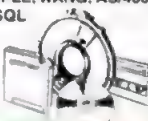
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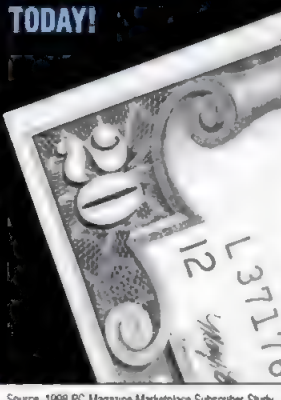
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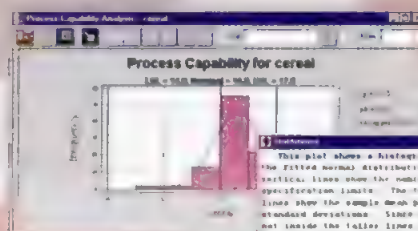
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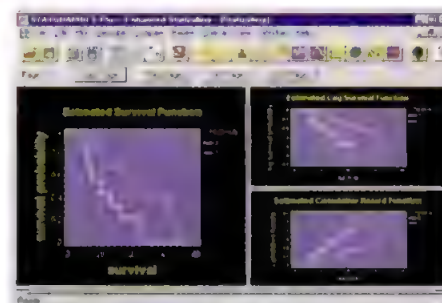
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This plot shows a histogram of cereal together with the fitted normal distribution. The upper value vertical line shows the nominal value and the specification limits. The two shorter vertical lines show the sample mean plus and minus 3 standard deviations. Since the shorter lines are not inside the taller lines, the process would be deemed to be incapable of meeting the spec. The area under the fitted distribution outside the specification limits equals 0.001587, implying that an estimated 4.15387% of the distribution should be out of spec.



AFTERHOURS

THE HOME SIDE OF COMPUTING



MUSIC ON THE INTERNET

Net Tunes

By Jan Ozer

When the Recording Industry Association of America (the RIAA) sued Diamond Multimedia last November to prevent the company from shipping the Diamond Rio PMP300 Portable Music Player, it let a very big cat out of an even bigger bag. The world suddenly realized the Net is the largest music store in the universe, open 24 hours a day 7 days a week, with more tunes than any ten stores could stock. There are no smirking counter clerks with multiple pierced body parts, either.

Although you can purchase retail CDs over the Internet, the most significant benefits extend beyond this simple convenience. Technologies such as RealAudio have familiarized us with the concept of listening to audio broadcasts—concerts, simulcast press conferences, or music tracks—in real time (called streaming audio) on our PCs. The technologies explored here give you the opportunity to download music files to your hard disk or burn them onto CD-ROMs.

When it comes to contemporary music, you can sample before you buy, you can usually

buy one or two songs instead of an entire album, and with the proper hardware, you can create CDs that play on your car and home stereo systems.

THE TECHNOLOGY STORY

To get started, you'll need an MP3 player or software that can play MP3-compressed audio files. That's because most Inter-

net music is compressed to enable faster distribution and require less local storage. MP3, or MPEG Audio Level 3, is the audio side of the MPEG video specification, which offers near-CD-quality sound at very high compression ratios.

A public standard, MP3 has emerged as the Internet's most popular compression format. Microsoft Windows 98 includes an integrated MP3 player, as does the new Microsoft Windows Media Player; you can also download a free MP3 player at a number of sites, including www.mp3.com. All players let you listen to MP3 files, and some also convert them to WAV files that can be burned onto CD-ROM, a process described below.

Though many sites sell or otherwise distribute legitimate MP3 files, a growing number make available unauthorized files, violating the copyrights of record labels and artists. In the record industry's eyes, this makes MP3 a fox in the digital hen house, eating chickens and eroding profits.

In fact, the popularity of the MP3 format was the real motivation behind the RIAA's suit to enjoin Diamond's shipment of the Rio, the industry's first portable MP3 player. Diamond ultimately won and the Rio shipped, though the RIAA appealed the decision.

Whether successful or not, the RIAA lawsuit won't immediately affect the distribution of legiti-

GRIM FANDANGO

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CAESAR III

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QUICK CLIPS

Burn up the highways, tackle the slopes, or become a railroad magnate. A brief look at six new titles. Page 248.

ILLUSTRATION BY JOSE CRUZ

AFTER HOURS

mate MP3 files over the Internet. This makes knowing how to work with MP3 files invaluable for those seeking to mine music on the Web.

SIMPLE AS A2B

An MP3 player is not the only musical decoder ring you'll need, however. The record industry's concern over MP3 has spawned several technologies that provide similar compression schemes—plus copyright protection. Most notable are Liquid Audio (www.liquidaudio.com), and AT&T's a2b Music (www.a2bmusic.com).

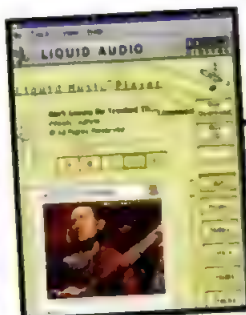
These technologies provide significant distribution flexibility, which in turn encourages record companies to release additional music for online listening or download. Both can limit playback of the audio file to the computer that originally downloaded it and can time-out playback after a certain number of days.

These technologies also appear in players that provide liner notes, lyrics, and album graphics, enhancing the listening experi-

ence. Though only Liquid Audio offers the ability to burn downloaded tracks to CD-ROM, AT&T plans to introduce this capability soon.

Finally, RealAudio (www.real.com) may also play a role in

Liquid Music Player:
Free. Liquid Audio Inc.,
850-549-2000,
www.liquidaudio.com.



your music hunt, primarily at sites featuring MP3 files. Most MP3 files contain 128K of data per second of music, which translates into long wait times to sample the music. For this reason, many MP3 sites also offer instant streaming previews via RealAudio, as do several Liquid Audio sites.

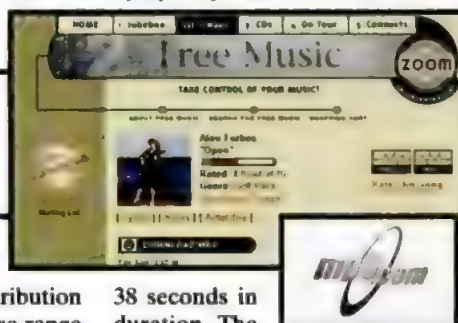
NOW IN AISLE THREE

Though you can buy retail CDs online, the Internet offers a much wider selection and a range of business models. Some sites, such as GoodNoise (www.goodnoise.com), function like boutique record labels, signing a small number of bands and dis-

tributing their albums. You can sample 30-second clips from all songs in MP3 and RealAudio format and even download a free MP3 song or two, but you can't buy a CD-ROM online. Instead, you buy and download all your selections, usually at \$0.99 per song and \$8.99 per album.

By contrast, MP3.com (www.mp3.com) represents nearly 2,000 artists—some no-name, some well known. Every band selects one song from each of its albums for free distribution, so you can download a diverse collection of music without paying a cent. To get a complete album by a single artist, though, you have to buy the physical CD (usually for under \$10).

MusicMatch.com has
RealAudio previews, free
MP3 songs, lyrics, notes,
and artist bios.



Amplified.com (www.amplified.com) pursues a straight distribution model, offering a diverse range of artists such as Richie Valens, Frank Sinatra, and Billie Holiday using Liquid Audio and including RealAudio previews. Songs typically cost \$0.99, and you can purchase only via download.

If your goal is to download individual songs, don't set your sites on popular albums from mainstream artists: Most record companies don't release best-sellers for download distribution to avoid conflicting with store-based distribution. On the other hand, if you're looking for hard-to-find songs unavailable in record stores, boot up your computer, fire up the modem, and crank up those speakers: You're probably in the right place.

Here's a look at how to get what's out there.

LIQUID AUDIO

We began our search at www.amplified.com, which features a great selection of artists in most

popular categories. We downloaded the 1.5MB Liquid Music Player and applied for a *passport*, which required contact and credit card information.

Each song costs \$0.99, which you pay by reentering address and credit card information. Liquid Player manages downloads, but you can't sample or purchase other tracks while downloading. This means you can't download a track from one site as you browse and sample from others.

Liquid Audio tracks contain about 252K of data per second of music—about twice as much as MP3 files—which extends download times. For example, it took 27 minutes to download an excerpt from Beethoven's Fifth Symphony that was 5 minutes

38 seconds in duration. The clip's audio quality, however, was virtually flawless.

Downloaded files are keyed to Liquid Audio's passport data and will play only on your computer. Liquid Player also controls burning the tracks to CD-ROM. You can burn a song only once, and all songs are watermarked with your passport information, so copies can be tracked.

Unfortunately, CD-R support is limited, though Liquid Audio has announced that it will work with Adaptec to extend support during the first quarter of 1999. Until then, check www.liquidaudio.com to make sure your CD-R drive is supported.

MP3 SITES

We decided to pad our collection with MP3 songs, starting at www.musicmatch.com. We scanned the site's top 100 free downloads and grabbed Janis Ian's moving song "Take No Prisoners."

PC EDITORS' HOT LINKS

www.pcmag.com

Just as it can be a bit overwhelming to search through racks and racks of CDs and tapes at your local music store, hunting down the hottest music sites on the Internet can be daunting. In addition to those mentioned in the story, here are a handful of our favorite sites:

► Digital Phono

www.digitalphono.com

A great place to find off-the-beaten-path tracks in a2b Music format, Digital Phono is in its infancy but shows great promise.

► Direct Audio

www.directaudio.com

This site lets you preview and

buy tracks from hundreds of artists using Liquid Music Player.

► MP3box mp3.box.sk

A great starting place, this site provides MP3 software, news, and great links to other sites.

► MP3now

www.mp3now.com

It bills itself as the "Ultimate MP3 Resource" and that's not just talk: MP3 downloads, top 100 charts, search engines, and software abound.

► MP3park

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AFTER HOURS

Unlike with Liquid Audio, your browser handles downloads, so you can start shopping right away and even download multiple files simultaneously. We checked MP3.com's free listing and picked up "Walk On By" by Dionne Warwick, "Dust in the Wind" from Kansas, "Sweet Home Chicago" from the Blues Brothers, and a surprisingly good cover of the Rolling Stones' "You Can't Always Get What You Want" by Paint It Blue.

We rounded off our CD-ROM compilation at www.nordicdms.com, paying \$0.99 each via credit card for Jimmy Hendrix's "Purple Haze," Ella Fitzgerald's "Mack the Knife," and Billie Holiday's "Body and Soul."

All files were encoded at 128 Kbps, compared with Liquid Audio's 252 Kbps, roughly halving download times. Audio quality was perfect to our ears, but audiophiles playing the songs on

professional stereo equipment might notice a flaw or two.

Although Windows Media Player played the MP3 files, it couldn't convert them to WAV format to burn on CD-ROM. So we downloaded Null-Soft's energetic WinAmp 2.05 (\$10 shareware, www.winamp.com) to convert the files to 44-kHz, 16-bit stereo files. Once in this format, we used CeQuadrat's just!audio (\$79 list, www.cequadrat.com) to create our compilation CD.

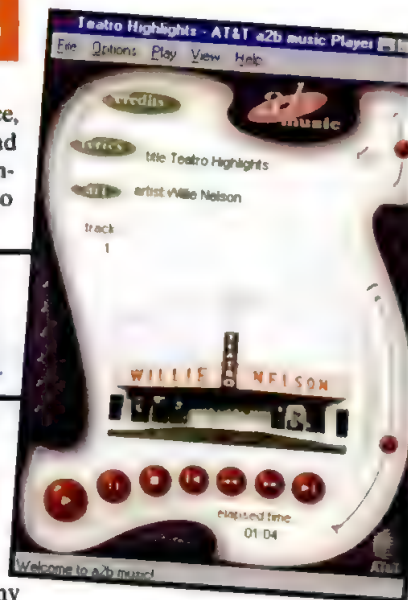
A2B MUSIC

A relative newcomer to the Internet audio space, AT&T's a2b Music technology is used solely for promotion, because you can't currently burn tracks to CD-ROM. To begin listening, download the 2.5MB a2b Music Player from www.a2bmusic.com.

.com. Guitarlike in appearance, a2b Player has playback and volume controls, a play-list controller, and access to cover art and lyrics.

a2b Music Player:
Free. a2b Music,
212-583-6800,
www.a2bmusic.com.

The a2b Web site is the best place to searching for a2b-encoded songs, and the collection includes an impressive list of current artists including Belinda Carlisle, Lenny Kravitz, and Joe Walsh. All clips are in a2b format, which can't stream at modem connection speeds. Because a2b does not use RealAudio or other streaming technologies, 28.8-Kbps modem users will have to wait over 2 minutes to hear a 30-second preview—a needless waste of time.



In most instances, you can't download files without inputting your name and e-mail address, prompting scary visions of future junk e-mails that come true two or three days later. Downloads, however, are the most compact of all three formats, averaging about 122 Kbps while retaining nearly flawless quality. Unlike Liquid Audio, the technology lets you sample and download multiple files at the same time.

Once on your hard disk, a2b files can be played only by a2b Music Player. Publishers can choose to enable playback on multiple computers, however.

MUSIC TO YOUR EARS?

Few music sites approach the cushy comfort offered at more mature commerce sites such as Amazon.com. Most lack niceties such as one-click shopping, and few retain credit card information so you don't have to reenter it each time you buy. In addition, downloading files may prove frustrating to those connecting via modems, though users lucky enough to have DSL or cable connections can acquire a song in just a couple of minutes.

You don't have to look too far into the future, however, to see a world where polished sites and universal high-speed connections make buying music on the Internet a painless, near-real-time experience. But why wait? The treasure trove is out there waiting to be mined.

Talk Radio

You're working late, and you realize that your alma mater is playing your cross-town rival while you're struggling over the quarterly financials. Or maybe it's The Boss on tour and tonight's Manhattan concert is being simulcast over the Net. So you load a software program and speak into a microphone: "USC versus UCLA" or "Springsteen concert." Up comes a list of URLs with descriptions, which you can click to launch your RealAudio player and listen in.

Sound far-fetched? Maybe so, but this is the goal of Seattle-based Conversa and its TalkRadio Internet audio player, currently a beta product and scheduled to ship in the first half of 1999.

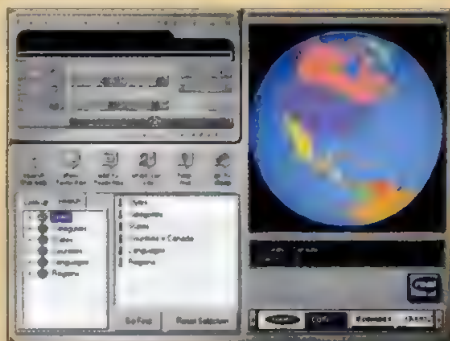
TalkRadio has two main components: a database of audio content and a speech recognition feature. Conversa started with a list of radio stations from the FTC, which it supplemented with its own research. It also plans to sign premium content providers such as Books on Tape, Comedy.com, and iTunes.com to provide content and programming

notes for ongoing and planned audio broadcasts.

TalkRadio tracks all audio on the Internet, live and on-demand, around the world. The player is initially handling only RealAudio content, though MP3 support is planned. Support for Microsoft NetShow has not been decided.

The player accepts typed searches, though the speech recognition technology makes the product more accessible to the less computer-literate. Although detailed searches, such as *USC versus UCLA* or *Springsteen concert*, will probably require support from premium partners, the system easily supports simple requests such as *sports radio*, *Los Angeles* or *rock concert station*, *New York City*, which should provide the same programming.

Conversa will distribute a free basic player over the Internet, as well as a retail player bundled with a microphone and headset for about \$50. (Conversa, 425-895-1800, www.conversa.com.)—JO



Nothing lasts longer.



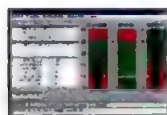
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AFTER HOURS

ADVENTURE

Grateful Dead

One of the most visually impressive games of the year, LucasArts' *Grim Fandango* is a lively trip through the Land of the Dead. You play Manny Calavera, a reaper—though hardly a grim one—who gets tangled in a plot to deprive decent souls of their final rewards.

Calavera is an employee of the Department of Death who not only collects departed souls but helps them travel through the Land of the Dead to the ninth underworld. Those who lived saintly lives are awarded passage on the gleaming Number Nine, a train that whisks them away in comfort. Those who were less than perfect are forced to walk, or worse, get mailed in a crate.

There's trouble in the here-

after, though: Someone is stealing the coveted Number Nine tickets and leaving the godly in the lurch. Worse for Calavera is that he gets points for those quality commissions. If he can't book decent passage for the departed, he can't work off his debt and move on.

Trying to help a sweet cadaver named Mercedes Colomar, Calavera leaves his job and traverses the Land of the Dead. The journey takes him over land and sea, through big cities and a petrified forest. The inventive variety of scenes should keep any gamer happy.

At all times, *Grim Fandango*

is a feast for the eyes. It's a fantastically realized world, blending Mexican and Aztec design with film noir techniques. Characters resemble the Mexican Day of the Dead skeleton figurines called *calaveras*.

If only the game play were as

logical, but too often players will scramble around trying anything that might work. The solutions seem so unlikely you'll wonder whether they were designed to sell game guides.

Those who stick with the game and don't give up are in



inventive as the visuals! At its heart, *Grim Fandango* simply requires you to collect all the objects you can, then use them in unusual ways. That would be fine if the puzzles were more

for a treat, as it unfolds in one crazy twist after another. *Grim Fandango* is an engaging game, but with more logical puzzles it could have been outstanding. —Troy Dreier

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Build Rome in a Day

As with the two previous installments of this popular strategic simulation series, the basic premise in the latest installment, *Caesar III*, is thus: As a citizen in ancient Rome, you must advance your career through the ranks of the Empire by building a fully functional and prosperous city. Along the way, obstacles such as disgruntled plebes and invading armies will impede your efforts to attain your ultimate goal—being crowned emperor of Rome.

The biggest difference in this version in comparison with its predecessors is the sheer number of challenges you encounter. This time around, for example, there are gods that need to be appeased (you must build temples or hold festivals in their honor). If un-

happy, an angry Ceres will destroy your harvest, thus depriving your people of food.

Caesar has been given increased input in this game. Unlike *Caesar II*, where he was passive and on occasion would merely request "gifts," *Caesar III* has him deliver ultimatums. Failure to comply with his wishes lessens your ability to



progress in the game.

Progress means planning: It takes organized thought and actions to ascend to the throne. For example, you can't build a pottery warehouse without first building a clay pit—which, of course, needs to be near water, because clay is found near riverbeds—and so on. Numerous provinces with varying weather conditions and topographical arrangements affect game play. If you are building in the desert, the chances of your buildings catching on fire increase, and in more temperate areas they crumble.

Graphically the game has been given an overhaul, with more detailed renderings. The citizens are also livelier: If you click on them they give you their impressions of city life.



CAESAR III
★★★★ \$50 street. Sierra Studios.
800-757-7707, www.sierra.com.

Caesar III proves a worthy addition to the series. It provides a welcome opportunity to learn about the history and operations of the ancient Roman Empire. *Res bene gesta propter experientiam* (success through knowledge).—Roderick A. Beltran



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Quick Clips

Backstage

 Theater buffs will be engaged and amused by this quirky behind-the-scenes look at the sights and sounds of the stage. Players navigate through backstage rooms, solving drama- and music-inspired puzzles. \$25 street; Clarence Sheridan; 800-562-4377; www.theater3d.com.

Heretic II

 Heretic II lets you experience the action from a third-person perspective. Players fight their way across the richly detailed environment



of Parthoris, with plenty of monsters to kill and spells to cast. You'll find lots of gore and lots of great game play in this one. \$46.95 list; Activision; 310-255-2000; www.activision.com.

Railroad Tycoon II

 If you can keep an eye on your finances, the economy, consumer demands, world events, and, of course, train robbers, you'll be able to build yourself a railroad dynasty in Railroad Tycoon II. As you fret over delayed shipments and rising costs, you'll have yourself a ball. \$49.95 list; Gathering of Developers; 214-880-0001; www.godgames.com.



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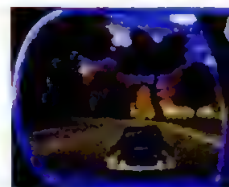
 With the help of favorite Richard Scarry characters such as Huckle Cat and Lowly Worm, your 3- to 7-year-old can color, watch cartoons, tackle mazes, and solve jigsaw puzzles. \$30 street; Simon & Schuster Inc.; 212-698-7000; www.ssiinteractive.com.

Skiing 1999

 Try your skill at five types of racing—downhill, slalom, giant slalom, super-G, and all-around—on six world-class slopes in Sierra Sports' fast-paced ski title. Video tips from Olympic gold medalist Picabo Street will help improve your form as you race against friends or the clock. \$29.95 list; Sierra Sports; 800-757-7707; www.sierra.com.

Speed Busters: American Highways

 Fun is the name of the game as you burn up the highways in Ubi Soft's latest racing title. The goal is simple: Go as fast as you possibly can through police radar checks and you'll win money, acquire better cars, and progress through the program's seven racetracks. \$44.99 list; Ubi Soft; 800-824-7638; www.ubisoft.com.



Coming Up

What's in the Next Issue of *PC Magazine*

The Right Upgrade

Are you itching to beef up your PC? You know you need more RAM or more storage. Or maybe you just want the darned thing to go faster. So which is the best upgrade path, and which components make the best upgrade candidates? In our next issue, PC Magazine Labs will test the full upgrade spectrum. We'll show you how to upgrade your system to make it a better multimedia station, as well as how to boost it to make better use of the Internet. And we'll let you know which upgrades don't make sense.

Combo Cards

Road warriors live (and die) with their PC Cards. We'll have a timely roundup of PC Cards that double as modems and network interface cards. We'll test and review cards with 56K and 10/100-Mbps Ethernet capabilities.

Auction Sites

One of the hottest recent crazes on the Internet is buying and selling at one of the many auction sites out there. We'll save you time by letting you know which sites are the best for the kind of things you want to sell or buy and which sites simply offer the best experience.



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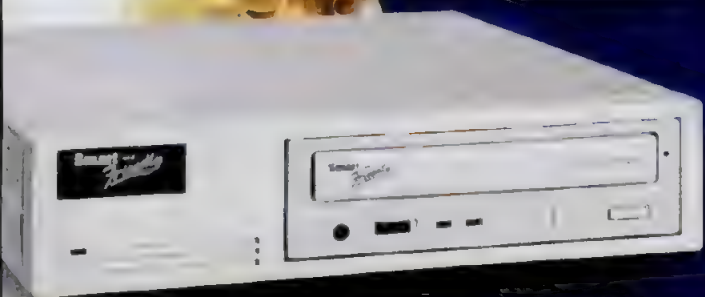
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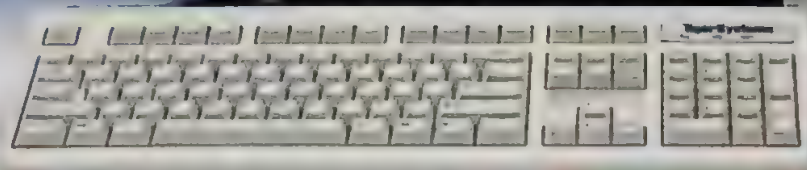
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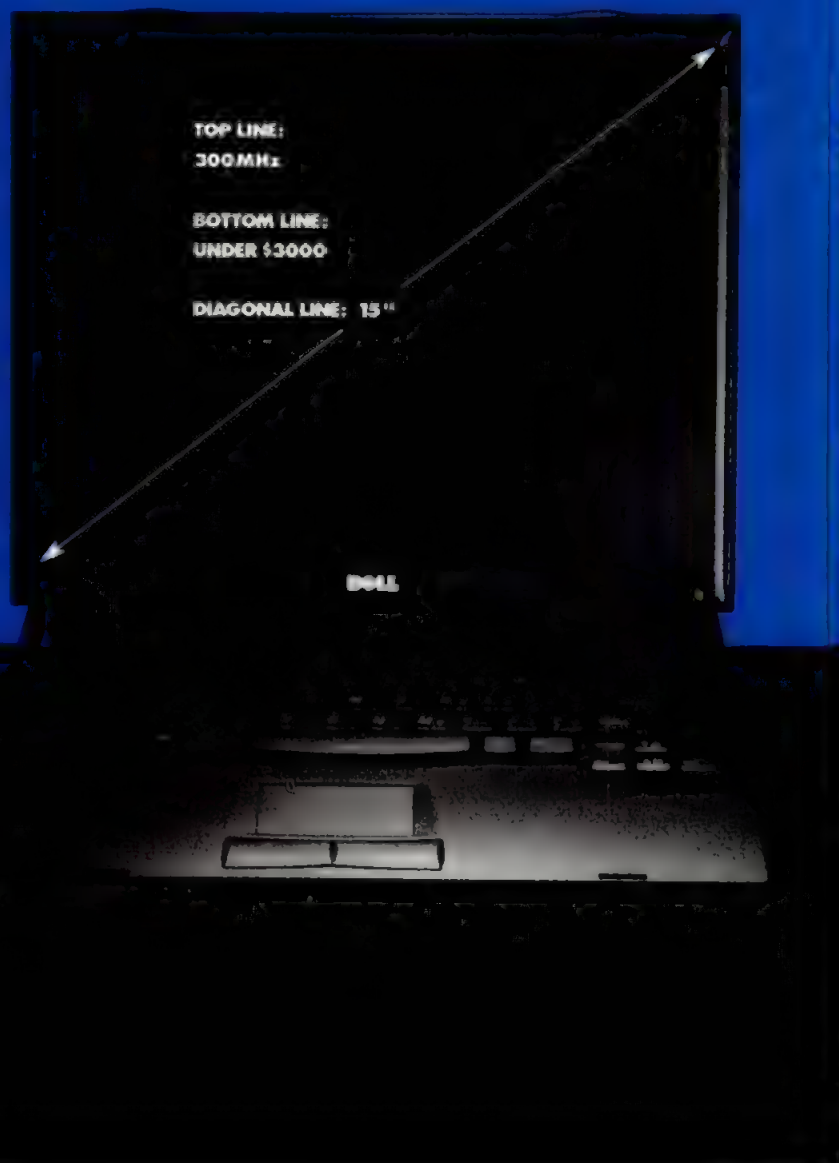
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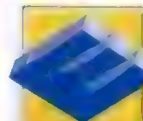
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- NEW 19" (18.0" viewable, .26dp) Trinitron P990 Monitor
- Diamond 8MB AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- 3Com 10/100 PCI TX NIC with Remote Wakeup
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- MS Windows NT® Workstation 4.0 and 1-Year NT Telephone Support
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support
- ★ Second Pentium II Processor at 450MHz, add \$849

\$3799
Business Lease¹: \$144/Mo., 36 Mos.
 E-VALUE CODE: 04012-490137

INESS

rdware Wavetable • 12-Cell Intelligent Lithium Ion Battery • S-Video Port • MS Office 97 Small ar) • MS Windows 98 • Touchpad • 3-Year Limited Warranty¹ **Common features for Inspiron**
py Drive • Modular 24X Max™ Variable CD-ROM • 9-Cell Intelligent Lithium Ion Battery • MS
000 Upgrade Offer) • MS Windows 98 • Touchpad • 3-Year Limited Warranty¹

OR D300LT OR AT 300MHz	DELL INSPIRON 3500 D266GT PENTIUM II PROCESSOR AT 266MHz	DELL INSPIRON 3500 D233XT PENTIUM II PROCESSOR AT 233MHz
Performance ix Display 18 Max™) Drive X Max™ Variable Drive GE Pro 3D Video V 90 Fax Modem rect DRAM, add \$99 Ultra ATA p, add \$99	Light Weight, Light Price 14.1" XGA Active Matrix Display 32MB SDRAM (256MB Max) 4.3GB Ultra ATA Hard Drive - NeoMagic MediaMagic 256AV AGP Video - APC SurgeArrest Notebook Pro ★ Upgrade to 64MB SDRAM, add \$99 ★ Internal 56K Capable™ V 90 Fax Modem, add \$59 ★ Upgrade to a 6.4GB Ultra ATA Hard Drive, add \$149 ★ Second Intelligent Lithium Ion Battery, add \$129	Light Weight, Light Price 13.3" XGA Active Matrix Display 32MB SDRAM (256MB Max) 3.2GB Ultra ATA Hard Drive - NeoMagic MediaMagic 256AV AGP Video ★ Upgrade to 64MB SDRAM, add \$99 ★ Upgrade to a 4.3GB Ultra ATA Hard Drive, add \$99 ★ Internal 56K Capable™ V 90 Fax Modem, add \$59 ★ Deluxe Nylon Case, add \$49 ★ Second Intelligent Lithium Ion Battery, add \$129 ★ 3-Year Next-Business-Day On-site³ Service, add \$149
	\$2379 Business Lease¹: \$90/Mo., 36 Mos. E-VALUE CODE: 04012-890123a	\$1999 Business Lease¹: \$76/Mo., 36 Mos E-VALUE CODE: 04012-890119

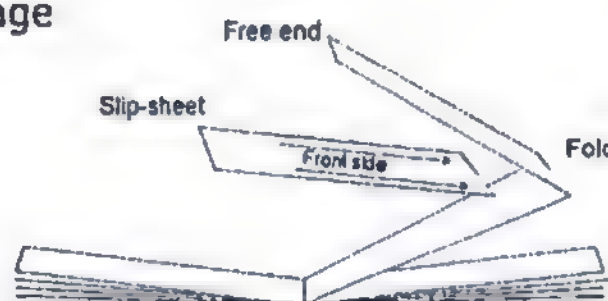
DELL POWEREDGE® SERVERS

Common features: • 512KB Integrated L2 ECC Cache • Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers • 32X Max™ Variable SCSI CD-ROM Drive • HP® OpenView™ NNM Special Edition • 3 External 5.25" Drive Bays plus Dedicated 3.5" Floppy Drive Bay • 6 Expansion Slots: 4 PCI, 2 PCI/ISA

DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 450MHz	DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 350MHz
(RAID 5 CONFIGURATION) 128MB 100MHz ECC SDRAM - Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives - Ultra-2/LVD PowerEdge Expandable RAID Controller 2/SC - Intel Pro/100+ PCI Ethernet Adapter 6-1" Hard Drive Bays 3-Year Next-Business-Day On-site³ Service 7x24 Dedicated Server Hardware Technical Telephone Support ★ Upgrade to 256MB 100MHz ECC SDRAM, add \$389 ★ APC Smart-UPS 700W Power Supply, add \$369	(DUAL PROCESSOR/RAID CAPABLE) 64MB 100MHz ECC SDRAM 4GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional) - Intel Pro/100+ PCI Ethernet Adapter 4-1.6" or 6-1" Hard Drive Bays 3-Year Next-Business-Day On-site³ Service 7x24 Dedicated Server Hardware Technical Telephone Support ★ Upgrade to 128MB 100MHz ECC SDRAM, add \$189 ★ Microsoft Windows NT Server 4.0 (10 Client Access Licenses), add \$799 ★ 12/24GB Variable SCSI DAT Tape Backup Unit, add \$749
\$5499 Business Lease¹: \$202/Mo., 36 Mos. E-VALUE CODE: 04012-290154	\$2449 Business Lease¹: \$93/Mo., 36 Mos. E-VALUE CODE: 04012-290124

¹Personal leasing arranged by Dell Financial Services L.P., an independent entity, to qualified customers. Amount of monthly lease payments above based on 36-month lease. All above monthly lease payments exclude taxes which may vary (for example, Hartford City, IN sales tax \$2.50/month). Shipping cost due with first payment. No security deposit required subject to credit approval and availability. Lease terms subject to change without notice.

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

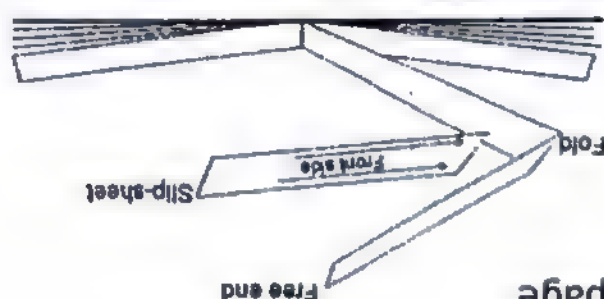


Foldout slip-sheet



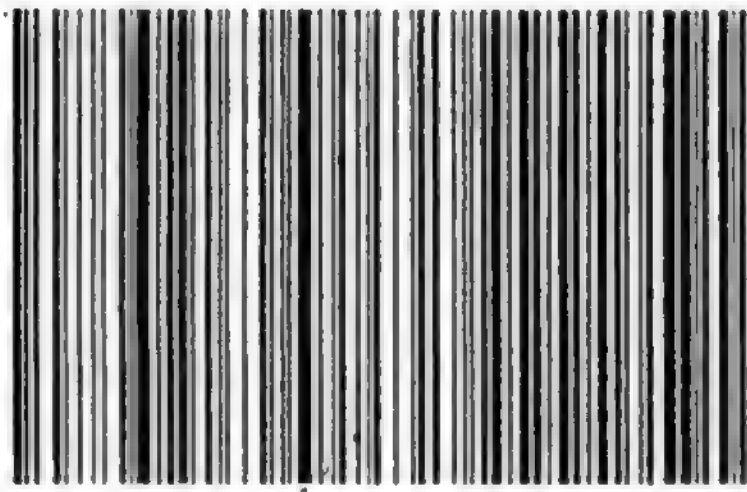
Inverted Foldout slip-sheet

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3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back

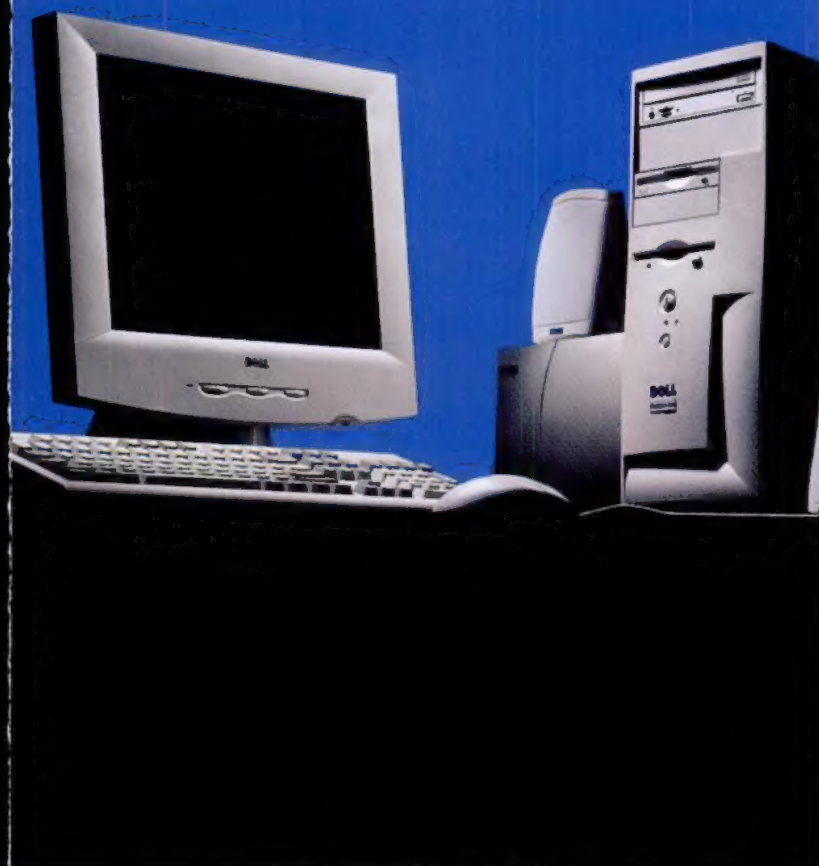


GbsSlipBack-0018

Back

1. Follow instructions on the other side

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Common features: Mini-Tower Model • 3.5" Floppy Disk Drive • McAfee VirusScan • MS Windows® 98 • Dell QuietKey® Key

DELL DIMENSION XPS R450 PENTIUM® II PROCESSOR AT 450MHz

- 256MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- NEW 17.2GB Ultra ATA Hard Drive
- NEW 15" (15.0" viewable) Flat Panel 1500FP Display
- 16MB STB nVidia TNT 3D AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Turtle Beach Montego A3D 64V Sound Card
- Altec Lansing ACS-295 Speakers with Subwoofer
- 3Com® 3C905B 10/100 NIC
- Iomega Zip 100MB Internal Drive with One Cartridge
- MS IntelliMouse®

Featured System

\$3199

Business Lease*: \$121/Mo., 36 Mos.

E-VALUE CODE: 04012-590131

DELL DIMENSION X PENTIUM II PROCESSOR

- 128MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- 14.4GB Ultra ATA Hard Drive (7200 rpm)
- NEW 21" (20.0" viewable) M1110 Monitor
- 16MB STB nVidia TNT Graphics Card
- 40X Max™ Variable CD-ROM Drive
- 3Com USRobotics V.90 Telephony WinModem
- Trial Offer ConnectDirect Internet Access
- MS IntelliMouse
- ★ Upgrade to a NEW 15" (15.0" viewable) Flat Panel Display, add \$225.

\$2479

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Common features for Inspiron 7000: 3D Surround Sound and Hardware Business Edition (Call about Our FREE MS Office 2000 Upgrade Offer). **3500:** 3D Surround Sound and Software Wavetable • Modular Floppy Drive • Office 97 Small Business Edition (Call about Our FREE MS Office 2000 Upgrade Offer).

DELL INSPIRON 7000 D300LT PENTIUM II PROCESSOR AT 300MHz

All-in-One Multimedia Performance

- 15" XGA Active Matrix Display
- 96MB SDRAM (384MB Max*)
- 4GB Ultra ATA Hard Drive
- Removable Combo 2X DVD-ROM Drive and Floppy Drive
- 2X AGP 8MB ATI RAGE Pro 3D Video
- Internal 56K Capable™ V.90 Fax Modem
- Trial Offer ConnectDirect Internet Access
- ★ Upgrade to 128MB SDRAM, add \$99.
- ★ Upgrade to an 8GB Ultra ATA Hard Drive, add \$299.
- ★ Iomega Zip 100MB Internal Drive, add \$149.

\$3199

Business Lease*: \$121/Mo., 36 Mos.

E-VALUE CODE: 04012-890131

DELL INSPIRON 7000 PENTIUM II PROCESSOR

All-in-One Multimedia Performance

- 15" XGA Active Matrix Display
- 64MB SDRAM (384MB Max*)
- 4GB Ultra ATA Hard Drive
- Removable Combo 2X DVD-ROM and Floppy Drive
- 2X AGP 8MB ATI RAGE Pro 3D Video
- Internal 56K Capable™ V.90 Fax Modem
- Trial Offer ConnectDirect Internet Access
- ★ Upgrade to 96MB SDRAM, add \$99.
- ★ Upgrade to a 6.4GB Ultra ATA Hard Drive, add \$149.
- ★ Custom Leather Case, add \$149.

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- 128MB 100MHz SDRAM
 - NEW 12.9GB Ultra ATA Hard Drive
 - 17" (15.9" viewable) 1000LS Monitor
 - 16MB STB nVidia TNT 3D AGP Graphics Card
 - 40X Max™ Variable CD-ROM Drive
 - Crystal 3D 64V Wavetable Sound
 - harman/kardon HK-195 Speakers
 - 3Com® USRobotics V.90® PCI Telephony WinModem
 - Trial Offer ConnectDirect™ Internet Access
 - Iomega Zip 100MB Internal Drive
 - Microsoft® Office 97 Small Business Edition v2.0 plus Bookshelf 98 (Call about Our **FREE MS® Office 2000 Upgrade Offer**; McAfee VirusScan
 - Microsoft Windows® 98
 - Dell QuietKey® Keyboard
 - MS IntelliMouse®
 - 3-Year Limited Warranty†
 - 1-Year On-site³ Service
 - Intuit QuickBooks v6.0
 - HP® DeskJet® 695C Color Printer
- ★ Upgrade to a 17" (16.0" viewable, .26dp) Trinitron® 1000HS Monitor, add \$109.

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- 128MB 100MHz SDRAM
- NEW 12.9GB Ultra ATA Hard Drive
- 17" (16.0" viewable, .26dp) Trinitron® 1000HS Monitor
- 8MB STB nVidia 3D AGP Graphics Card
- 4.8X DVD-ROM Drive and Decoder Card
- Turtle Beach Montego A3D 64V Sound Card
- ACS-295 Speakers with Subwoofer
- 3Com® USR V.90® PCI Telephony WinModem with Trial Offer ConnectDirect™ Internet Access^{ad}
- Iomega Zip 100MB Internal Drive
- MS® Works Suite 99 with Money 99 Basic; McAfee VirusScan
- MS Windows® 98/IntelliMouse®
- Dell Comfort Key Keyboard
- 3-Year Limited Warranty*
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- ★ ACS-495 Dolby Surround Sound Speakers with Subwoofer

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- 512KB Integrated L2 Cache
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- 17" (16.0" viewable, .26dp) Trinitron® 1000HS Monitor
- 16MB STB nVidia TNT 3D AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Turtle Beach Montego II A3D 320V Sound Card
- ACS-295 Speakers with Subwoofer
- Microsoft® Office 97 Small Business Edition v2.0 plus Bookshelf 98 (Call about Our FREE MS® Office 2000 Upgrade Offer); McAfee VirusScan
- Microsoft Windows® 98
- Dell QuietKey® Keyboard
- Logitech MouseMan Wheel (PS/2v)
- 3-Year Limited Warranty†
- 1-Year On-site^A Service

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Business Lease^o: \$83/Mo., 36 Mos.

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- ★ Iomega Zip 100MB Internal Drive

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